

**SREE CHITRA TIRUNAL INSTITUTE FOR
MEDICAL SCIENCES AND TECHNOLOGY**

TRIVANDRUM - 695 011, KERALA



ANNUAL REPORT

2022-23

Annual Report 2022-23

Sree Chitra Tirunal Institute for Medical Sciences and Technology
Trivandrum

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..... History

The origins of the Institute date back to 1973 when the Royal Family of Travancore gifted a multi-storey building, for the people of the region, and the Government of Kerala resolved to develop the gift as the Sree Chitra Tirunal Medical Centre for medical specialties. Sri P N Haksar, the then Deputy Chairman of the Planning Commission, inaugurated the Sree Chitra Tirunal Medical Centre in 1976, and patient services got under way. The Biomedical Technology Wing followed soon at the Satelmond Palace, an exquisite gift of the Royal family, located 11 km away from the Hospital Wing. The Vision of the first Director, Professor M S Valiathan, transformed the Centre into a unique institution that blends the practice of modern medicine with relevant research and technology within the same institutional framework.

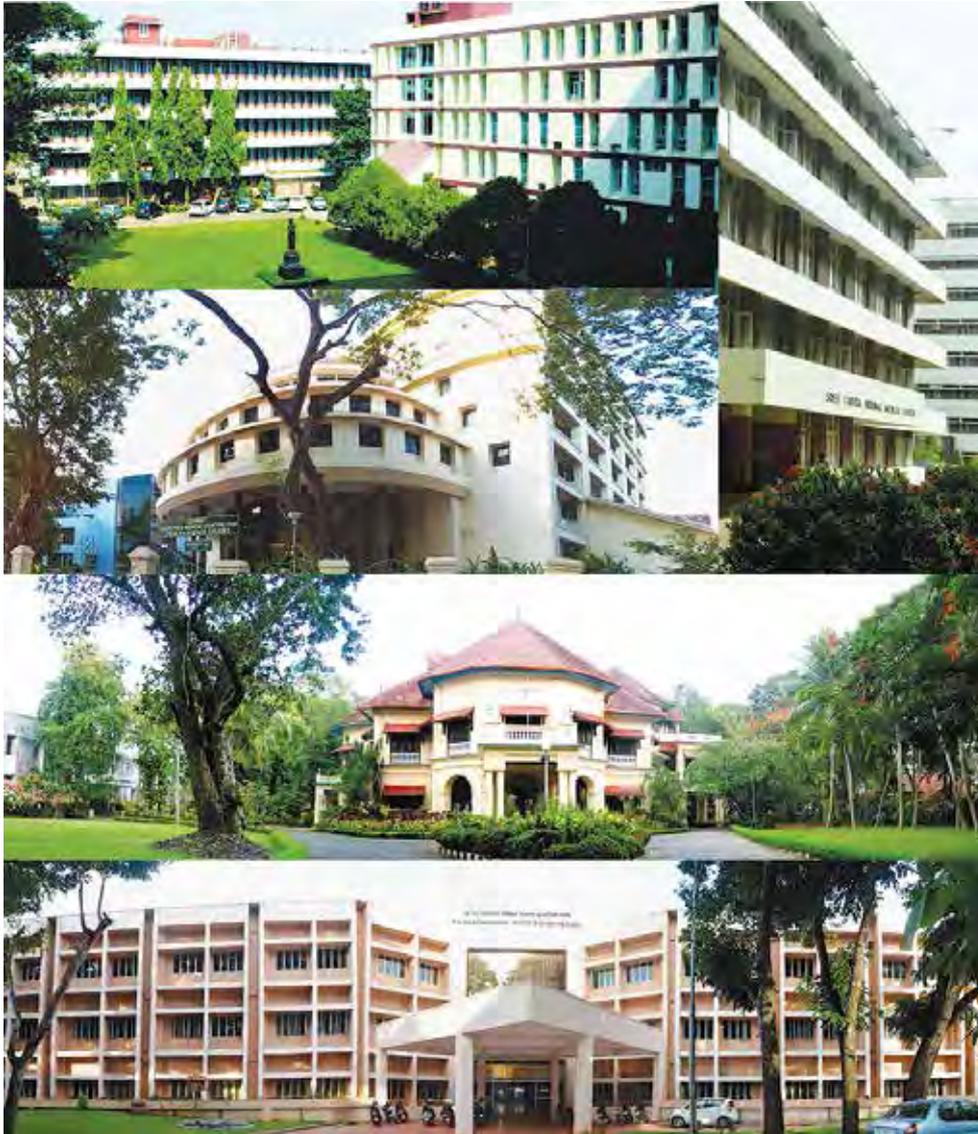
The concept of amalgamating medical sciences and technology within a single institutional framework was regarded sufficiently important by the Government of India to declare the Centre an Institute of National Importance under the Department of Science and Technology by an Act of Parliament in 1980, and name it as Sree Chitra Tirunal Institute for Medical Sciences and Technology, Trivandrum. Dr Manmohan Singh, the then Hon'ble Finance Minister, Government of India, laid the foundation stone for the third dimension of the Institute, the Achutha Menon Centre for Health Science Studies (AMCHSS), on June 15, 1992. AMCHSS was dedicated to the nation by Dr Murali Manohar Joshi, the then Hon'ble Minister of Science and Technology and Human Resource Development, Government of India, on January 30, 2000.

..... Our Mission

- Promote research and development in biomedical engineering and technology
- Deliver high quality patient care in selected specialties and sub-specialties
- Develop innovative postgraduate training programs in advanced medical specialties and biomedical engineering and technology
- Participate in public health reforms through research, training and interventions

..... Our Vision

- Become a global leader in affordable medical devices development, high quality patient care and health science studies





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MESSAGE

Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST) continues to have a significant impact on healthcare, medical research, and technology development. Our researchers have made notable contributions to various medical fields, including cardiac and neurosciences, interventional radiology, imaging sciences, basic medical sciences, public health research, and biomedical technology.

We have recently inaugurated the 'Combination Devices Block,' a 7-floor infrastructure at our Biomedical Technology wing, dedicated to advancing biomedical technology development. It was inaugurated by the Hon'ble Minister of Science & Technology Dr. Jitendra Singh. This block combines various scientific fields to further the development of biomedical devices and will house several new laboratories. We anticipate that it will contribute significantly to medical devices, testing services, intellectual property, scientific research, and publications.

Additionally, we are about to open a new 182-bedded Super Specialty Hospital Block under the Pradhan Mantri Swasthya Suraksha Yojana (PMSSY) Scheme which will cater to a substantial number of patients, enhancing our diagnostic and patient care services.

SCTIMST has played a pivotal role in developing medical devices and technology, significantly improving healthcare accessibility and affordability in India and other countries.

It is a matter of pride to state that three technologies (liquid embolic agent for application as a permanent implant occluding the abnormal blood vessels of the brain, drug eluting bioactive calcium sulfate cement and automatic smart trash bin for disinfection using UV enabled microwave) have been transferred during the year. One company that took our technology (porcine cholecyst extracellular matrix scaffold) got a manufacturing license from CDSCO for their biological tissue-based product. Several memoranda of understanding have been signed with industries and academic



institutions for joint development of medical devices. Non-disclosure agreements were signed with many leading intuitions for the testing of devices and the collaborative development of devices of mutual interest. During the year, 32 Indian patents were granted to the institute. 24 Indian patent applications and one foreign patent application were also filed.

Through its medical education and training programs at postgraduate, doctoral, and post-doctoral level courses, 168 students received their degrees/diplomas/certificates during the 38th Annual Convocation ceremony held on 21st May 2022. Among these, seven students completed their PhD program and 121 students in super-specialty courses (DM/MCh/PDCC/PDF/MD) obtained their degrees. 648 individuals received training/apprenticeship/internship opportunities in specialized areas of medical/biomedical/public health research. Apart from these structured courses, the institute also contributed substantially to manpower generation through Workshops/Conferences/ Training programs/ Popular lectures/ Awareness camps/ Seminars and exhibitions, within and outside the institute. Two noteworthy ones among them was the starting of an 'International Workshop initiative related to acute management of stroke' by the Department of Neurology along with the Department of Radiology and Neurology, University of Berne, Switzerland; and, the starting of the Prof. Rout oration by the Department of Neurosurgery.

A new initiative named the "Academic Fest" was started on every working Saturday where the research work of a department is presented in presence of the entire academic fraternity. Through its international lecture series termed 'SAMVAAD', eminent personalities have presented lectures that have been preserved as webinars. The staff of the institute have had the opportunity to listen to their wisdom and knowledge. The institute has also arranged several events aligning with the policies of the government, namely, Azadi ka Amrit Mahotsav, International Yoga Day, International Rural Women's Day, World Environment Day, Swachhta Pakhwada, and National Science Day to create awareness in various areas of knowledge and discipline. The institute also organized the World Parkinson's day, World Hand Hygiene Day Cyber Jaagrookta Diwas celebration, World Heart Rhythm Week celebration, World Blood Donor Day, International Day of Radiography, World Antimicrobial Awareness Week, National Voluntary Blood Donation Day, Epilepsy Awareness Purple Day and International Sleep Day. The newsletters, 'Chitrlekha' and 'Chitradhwani' continued its reporting of the activities of the institute.

SCTIMST researchers have published numerous scientific papers and contributed to the academic and scientific community's understanding of various medical and healthcare-related topics. About 276 research papers were published by SCTIMST and the faculty and students of SCTIMST gave 320 scientific international and national presentations.

The members of the faculty, residents, nursing and technical staff of SCTIMST won several awards and accolades at the national and internal levels, which is a great recognition of the contributions the institute makes to the national and global community. Among the notables accolades received were the 11th National Petrochemicals Award from the Minister of State for Chemicals and Fertilizers and New and Renewable Energy; Lifetime Achievement Award from the Indian Society of Blood Transfusion Immunohematology; 'LMIC (Lower- or Middle-Income Country) Investigator Award', from the International Behavioural Trials Network (IBTN) and University of Montreal, Canada; nomination as Advisory board member, World Health Organisation Global Health Foresight Horizon Scan Exercise; membership of the Lancet Citizens Commission; membership of the Expert Committee to endorse the activities of the Alliance for Health Policy and Systems Research by the WHO; BRICS young scientist award; and, Fellowship of European Board of Cardiothoracic Surgeons (Congenital Cardiac Surgery). Expertscape, an international *agency from the USA* placed SCTIMST as the eighth best institute in the world based on its contributions to clinical, academic, and research work in areas of cardiac rhythm disorders.

Noteworthy initiatives taken by the Institute include the launch of the peer-reviewed, multi-disciplinary journal 'Opinions in Medical Sciences Technology & Health' (<https://omsth.sctimst.ac.in/omsth>).

SCTIMST received DBT-SAHAJ Infrastructure project titled, 'National Translational Research Facility for Biomaterials, Medical Devices and In vitro Diagnostics (IVDs)' with an approved budget of Rs. 9.5 crores.

SCTIMST has been implementing two projects for the empowerment of scheduled caste and scheduled tribe students with a budgeted outlay of Rs 6.12 crore. These projects aim to bring an impact on the education, skill development, employability and health of students belonging to Scheduled Caste and Scheduled Tribe communities in the country through a series of interventions.

The Ayushman Bharat Pradhan Mantri Jan Arogya Yojana/Kerala Arogya Suraksha Padhathi (ABPMJAY/KASP) was implemented, permitting the poor patients of the region get free or subsidized treatment in the institute.

The Division of Pediatric Cardiology, initiated a destination program – "Fontan Clinic". This is the first dedicated clinic in the country contributing to the care of patients with complex congenital heart diseases who are managed with multiple staged surgeries along the univentricular pathway, the final surgery of which is referred to as the Fontan repair.

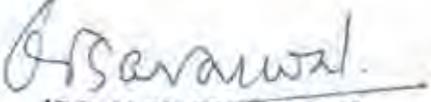
A new clinic, 'Heart in Pregnancy' Clinic, was initiated by the Division of Paediatric Cardiac Surgery in collaboration with Department of Cardiology, SCTIMST and the Department of Obstetrics and Gynaecology, SAT Hospital, Trivandrum, to take care of pregnant women with heart diseases.

The institute places on record its deep sense of gratitude to the Department of Science and Technology for its unwavering support at all times. It is also grateful to the Department of Health and Family Welfare for its support in the construction of the PMSSY new hospital building and the procurement of equipment for it.

Let us celebrate our accomplishments, recognize our strengths, and chart a course for an even brighter future. Together, we will continue to push the boundaries of knowledge, advance healthcare, and make a meaningful impact on the lives of those we serve.

As we reflect on our achievements, we must also look forward. The challenges we face continue to evolve, and it is our responsibility to adapt and lead. The SCTIMST community has always been known for its ability to innovate and adapt to changing circumstances, and I do not doubt that we will continue to do so in the years ahead.

I extend my heartfelt gratitude to every member of the SCTIMST Trivandrum family for their unwavering commitment and relentless pursuit of excellence. Your hard work and dedication are the driving forces behind our success.


(DR. V. K. SARASWAT)
President, SCTIMST

New Delhi

29.09. 2023



Dr Sanjay Behari, Director, SCTIMST

“Ah, but a man’s reach should exceed his grasp or what’s a heaven for?” Robert Browning

It is with immense pride and a feeling of synergy that I address you in this message for the ‘Annual Report 2022-2023’ of the Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Trivandrum. The past year has been a testament to our collective dedication and unwavering commitment to our mission towards advancing healthcare, public health, medical device development, research and education.

The year under consideration has been a duration focused on several new endeavours. New infrastructure is being built and state-of-the art-equipment being established. In addition, unique healthcare related technologies have been transferred, networking with several leading institutions has been started, and several new collaborations in the areas of academics, health, research, and technology development have been initiated.

Our research ventures have continued to break new grounds, addressing critical issues in the imparting of healthcare, in the dissemination of public health and in the development of biomedical technology that are relevant to our country. The dedication and passion of our researchers and their collaborators have resulted in the translation of novel technologies, 276 research publications, 32 Indian patents and several design registrations in the last year that have the potential to transform the medical landscape of the country. The esprit de corps and the fervent desire to uphold as well as enhance the name of the institution is all-pervading in every existing cadre. This is exemplified in our achieving the National Institutional Ranking Framework (NIRF) rank of 9 among medical institutions of the country in the year 2022-23.

Our educational programs have also evolved to meet the changing needs of our students. During the year, we introduced the 5-year integrated PhD programs for MD/DM and MCh students for the first time in the country. Intramural funds for consultants as well as institute supported PhD courses have also been started. SCTIMST is a much sought-after destination for super-specialty courses leading to the DM and MCh degrees, post-doctoral fellowship programs, and PhD programs in neuro-and cardiac- sciences as well as allied and basic science specialties. The public health and biomedical technology development courses as well as the nursing and technician training programs are among the most sought-after educational initiatives in the country. We ensure that our students receive a world-class education, equipping them with the knowledge and skills needed to excel in their respective fields.

Patient care remains at the heart of our institution's mission, and the efforts of our healthcare professionals in this arena have been nothing short of being exemplary. They have displayed an unwavering commitment to providing compassionate and high-quality care to those in need. The impact of their efforts on the health and well-being of countless individuals is immeasurable. The unflinching support of the nursing, technical, administrative and paramedical staff members is the foundation on which the edifice of imparting of tertiary care health services is built. The support and guidance by the Department of Science and Technology (DST) has gone a long way in helping us achieve our objectives. I am grateful to the Secretary, DST and officials of DST for their constant help. The immense guidance given by our Hon.President and members of Governing Body, Institute Body and other statutory bodies have constantly helped us in pursuing the right path. The support provided by Government of Kerala is also greatly appreciated.

I would like to extend my heartfelt gratitude to every member of the SCTIMST family for their hard work, dedication, and resilience. The contributions of each one of the "Sree Chitra fraternity" have been instrumental in shaping our institution's success. I am truly privileged to be a part of this exceptional team. George Eliot once said, "It is never too late to be what you might have been". Together, we will strive to continue our efforts to make a meaningful impact on a brighter and healthier future for all.

Dr Sanjay Behari

Highlights of the Year 2022-2023

INFRASTRUCTURE DEVELOPMENT

- ◆ The construction of Combination Devices Block in the Biomedical Technology Wing, has been completed. The building was inaugurated by Dr Jitendra Singh, Minister of State (Independent Charge) of Science and Technology, in the formal function held on 15th November 2022 in the Campus.
- ◆ The construction of the new 182 -bedded Super Specialty Hospital Block under the Pradhan Mantri Swasthya Suraksha Yojana (PMSSY) Scheme is in the final stage and the facility is expected to be inaugurated by December 2023.

CONTRIBUTIONS TOWARDS NATIONAL MISSIONS

1. “Make in India”

◆ Product Development

A. Manufacturing license

- M/s. Alicorn Medical Pvt. Ltd received the manufacturing license from CDSCO for porcine cholecyst extracellular matrix scaffold - Cholederm TM, the technology of which has earlier been transferred by the Institute.

B. Technology Transfer

- The license agreement with M/s Biorad Medisys Pvt Ltd for the technology transfer of liquid embolic agent for application as a permanent implant occluding the abnormal blood vessels of the brain was signed on 3rd October 2022.
- The license agreement with M/s Onyx Medicals Pvt Ltd for the technology transfer of Drug Eluting Bioactive Calcium Sulfate Cement was signed on 13th September 2022.
- The license agreement with M/s Forsta Meditech Private Limited for the technology transfer of Automatic Smart Trash Bin for Disinfection Using UV Enabled Microwave (Astra) was signed on 23rd June 2022.

C. MoU/Collaborative product development

- The following memoranda of understanding (MoUs) were signed -
 - With M/s Phraction Scientifics Private Limited on 31st March 2022 for joint development of platelet concentrator and segregator.
 - With M/s Abhaya 3CD Private Limited on 5th July 2022 for a project which imparts technical support on the regulatory aspects for the male incontinence device developed by the company.



- With Central Manufacturing Technology Institute (CMTI), Bangalore on 20th August 2022 for the development of scalable technology for fabrication of polymeric micro devices for biomedical applications.
- With Government Engineering College, Barton Hill, Thiruvananthapuram on 16th August 2022 to promote co-operation in research and development in areas of mutual interest.
- with IIT Kanpur on 30th August 2022 for collaboration in academics, research and technology development
- With Christian Medical College (CMC) Vellore on 8th December 2022 for collaborative research in evaluating the circulatory exosomes and exosomal miRNAs in Systemic Sclerosis patients for predicting disease progression/organ damage.

The following Non-Disclosure Agreements were signed -

1. With the Post Graduate Institute of Medical Education and Research (PGIMER) for testing of C1-2 artificial joint and research aspect.
2. With M/s GESCO Healthcare Pvt Ltd on 9th December 2022 for development of prototypes of neurosurgical devices.
3. With Andhra Pradesh Medtech Zone Ltd (AMTZ) on 9th February 2023 for exploring possibility of collaboration / technology transfer

◆ **Technical Research Centre for Biomedical Devices**

In phase 1 of TRC, a total of 55 projects were executed, out of that 14 projects were related to COVID-19 technologies. Several class III devices were developed as part of the TRC program. The major outcomes of the TRC projects are listed below:

Technologies transferred	: 35
Technologies nearing transfer stage	: 4
Patent applications filed	: 100
Design registrations	: 17
Publications	: 33
Technical manpower trained	: 203
Training programs conducted	: 35

Several industry/institutional linkages were established and a National Petrochemical Award was also received for one of the technologies developed with TRC funding.

◆ **Technology Business Incubator (SCTIMST-TIMed)**

1. Two of TIMed incubatees were part of 75 select startups invited for BIRAC startup expo as part of Azadi Ka Amrit Mahotsav celebrations on 9-10 June 2022 at Pragati Maidan which was inaugurated by Hon'ble Prime Minister. One of the startups of TIMed was showcased in the DST Startup Utsav held at New Delhi on 12th Aug 2022.



2. Second cohort of the BIRAC supported SPARSH Social Innovation Immersion Program on the Theme of “Food and Nutrition” officially commenced on 15th April 2022 at TIMed, which is a BIRAC supported SPARSH Centre.
3. Under the National Biopharma Mission supported TIPS@TIMed project, 12 MoUs were signed with Universities and Research Institutions. More than 20 webinars on IPR and Technology Transfer, over 15 outreach programs and 8 patent filing facilitation were accomplished by TIPS@TIMed.
4. Based on the performance in earlier cycles, sanction of funding support for 4th cycle of PRAYAS scheme of DST was approved for TIMed.

D. Intellectual Property Rights

Number of patents granted: 34 (Foreign = 2, Indian = 32)

Number of patent applications filed : 26 (Foreign = 1, Indian = 25)

Number of Design Registrations : 17

2. “Skill India”

5. Industry-Institute Partnership Cell

Industry-Institute Partnership Cell (IIPC) of the institute organized 3 workshops involving the academia and medical device industry.

6. Competency Development Cell

The Competency Development Cell (CDC) organized 4 training programmes for the staff and faculty of the Institute during the year.

7. In-reach programs/ Student visits

In order to introduce the Institute activities to the young generation, regular visits were organized from graduate and under-graduate science students for colleges and academic institutions. This included an introductory session on Biomedical Technology and an exhibition of product development activity, followed by visit to research labs in the Biomedical Technology Wing Campus. This year, 15 such in-reach/ student visit programs were conducted.

3. “Digital India”

The Computer Division of SCTIMST has developed the following software-related activities:

- A dedicated webpage for Dural Arteriovenous Fistula Referral and Research (<https://dafd.sctimst.ac.in>)
- Gender Advancement for Transforming Institutions (<https://www.sctimst.ac.in/GATI>),
- Institute Journal OMSTH Portal (<https://omsth.sctimst.ac.in/omsth>)
- Alumni association website (<https://alumni.sctimst.ac.in/>).



NETWORKING WITH OTHER INSTITUTIONS

A. Memoranda of Understanding (MoU) for academic collaboration signed with the following Institutions :

- Dayanand Sagar College of Engineering, Bangalore, and M/s. Heart-health Pvt. Ltd. for the validation of AI-based myocardial scar quantification software.
- Indian Institute of Technology (IIT) Madras for developing computational tools for the management of intracranial aneurysms.
- Saveetha Dental College and Hospitals, Chennai, for research collaboration in the area of Dentistry.
- Postgraduate Institute for Medical Education and Research (PGIMER), Chandigarh, for the collaborative research on, 'Cost-effectiveness of Pradhan Mantri Bhartiya Janaushadhi Pariyojana (PMBJP) and its impact on financial risk protection in India.'
- Kerala Medical Services Corporation for the annual appraisal of the '108' Ambulance Service in Kerala.
- Central TB Division of the Ministry of Health and Family Welfare, Govt. of India, for implementing the research project on 'Adapting surveillance (Nikshay) data to create decision support systems for tuberculosis elimination in Kerala using spatial epidemiology'.

B. Collaborations initiated

- Collaboration established with Rajiv Gandhi Centre for Biotechnology, Trivandrum for the development of a point-of-care device for estimating biomarkers in patients with heart failure.
- The "Dementia Science Program: Incidence/Prevalence/Risk/Intervention analysis of dementia and basic research thereof"- A Multicentre study with AIIMS, NIMHANS, Bangur Institute of Neurosciences (BIN), NBRC and, University of Calcutta was initiated with funding from Department of Biotechnology, Govt. of India.
- Collaboration studies established with the University of Leeds for the scaffold and bone cement materials using human bone marrow mesenchymal stem cell cultures.
- A collaborative project established between M/s. Abhaya 3CD Private Ltd., Chennai to for developing male Urinary Incontinence Devices. Obtained the Test Manufacturing License from Central Drugs Standard Control Organization (CDSCO) for conducting product testing.

NEW INITIATIVES

- The Institute started a peer-reviewed, multi-disciplinary journal with the title, 'Opinions in Medical Sciences Technology & Health (OMSTH)', (<https://omsth.sctimst.ac.in/omsth>).
- SCTIMST received DBT-SAHAJ Infrastructure project titled, 'National Translational Research Facility for Biomaterials, Medical Devices and In vitro Diagnostics (IVDs)' with an approved budget of Rs. 9.5 Crores.



- SCTIMST has been implementing two projects for the empowerment of SC and ST students with a budgeted outlay of Rs 6.12 Crores. These projects aim to bring an impact on the education, skill development, employability and health of students belonging to Scheduled Caste and Scheduled Tribe communities in the country through a series of interventions.
- Implemented Ayushman Bharat Pradhan Mantri Jan Arogya Yojana/Kerala Arogya Suraksha Padhathi (ABPMJAY/KASP).
- The Division of Pediatric Cardiology, initiated a destination program – “Fontan Clinic”. This is the first dedicated clinic in the country dedicated to the care of patients with complex congenital heart diseases who are managed with multiple staged surgeries along the univentricular pathway, the final surgery of which is referred to as the Fontan repair.
- New clinic, Heart in pregnancy clinic, was initiated by the division of Paediatric Cardiac Surgery in collaboration with Dept. of Cardiology and Dept of Obstetrics and Gynaecology, SAT Hospital, Trivandrum to take care of pregnant women with heart diseases

RESEARCH PROJECTS/PUBLICATIONS/PATENTS

- ◆ **Number of research projects initiated during the year:**
 - Nationally funded: 29
- ◆ **Number of research publications: 276**
- ◆ **Patents**
 - Granted: (Indian=32; Foreign: 2)
 - Applications filed: (Foreign=1; Indian=25)

HUMAN RESOURCE DEVELOPMENT/TRAINING

- ◆ **PhDs graduated: 7**
- ◆ **Research/Technical manpower trained in DM/MCh/PDCC/PDF/MD: 121**
- ◆ **Other Research/Technical manpower trained in MPH/DPH/Diploma courses/projects/Apprenticeship/Observership: 648**
- ◆ **Manpower trained in affiliated programs (CMC-Vellore, NEI-Chennai, IIPH-Delhi, IIITM-K, Trivandrum): 57**
- ◆ **Apart from these structured courses, the institute also contributed substantially to manpower generation through Workshops/Conferences/Training programs/Popular lectures/Awareness camps/Seminars and exhibitions, within and outside the institute.**

EVENTS/CONFERENCES/WORKSHOPS

- ◆ **Annual Convocation**
 - The institute conducted the 38th Annual Convocation ceremony on 21st May 2022. In total, 168 students were awarded degrees/diplomas/certificates during the year 2022-2023.
- ◆ **SAMVAAD International Lecture Series**



- An international online lecture series was launched on 24th June 2022, with the inaugural lecture by an eminent neurosurgeon, Dr. Sunil K. Bhatia. Dr. R. Chidambaram, former principal scientific advisor, Govt. of India, Dr. Richard A. Cash, Dept. of Global Health and Population, Harvard TH Chan School of Public Health, Boston, and 5 other prominent Indian researchers have delivered SAMVAAD lectures.

◆ Azadi ka Amrit Mahotsav

- The Institute actively took part in the celebrations of the 'Azadi ka Amrit Mahotsav' (AKAM). During the year, 88 programs were brought under AKAM celebrations.

◆ International Yoga Day

- International Yoga Day was celebrated in the institute on 21st June 2022. A live yoga training program was conducted. Staff, students, and pensioners participated in the program. In addition, an open air yoga public program was conducted at Golf Club, Kowdiyar. An online webinar on "5 min: yoga break@ work place" was conducted on 18th June 2022 by Dr. Arun Thejaus, Assistant Professor, NITTE.

◆ International Rural Women's Day

- The day was celebrated on October 15, 2022, under the guidance of the 'Gender advancement for transforming institutions' (GATI) scheme of the Department of Science and Technology, Government of India and Department of Women and Child Development, Government of Kerala. A program was organized at the Dr Ambedkar Vidyaniketan CBSE Model Residential School, Njaraneeli, Thiruvananthapuram district which is the only CBSE School for tribal students under the Scheduled Tribes Development Department, Government of Kerala. Dr Rupa Sreedhar, Medical Superintendent and the Chairperson, GATI, SCTIMST delivered a talk on healthy diet and lifestyle for adolescents and Dr Jayasree R S introduced the fields of Science, Technology, Medicine and Mathematics (STEMM). A medical camp was also organized under the leadership of Dr Karthika Ajit, Dr Sayoojya Sachithanandan and Ms Smita AS, Assistant Nursing Superintendent.

◆ World Environment Day

- World Environment Day was celebrated on 5th June 2023 under the 'Azadi ka Amrit Mahotsav'. The event was inaugurated in the hospital by the Director, Prof. Sanjay Behari. Tulsi plants were handed over to student volunteers of the Youth Red Cross unit and staff members of SCTIMST to initiate a 'Tulsivan Ayush Udyan'. Director gifted tree saplings to Dr. Harikrishna Varma, Head, BMT Wing and team, to start an urban forest project area in the BMT Campus.

◆ Progressive use of Hindi

- During the year, Hindi Cell organized "Hindi Fortnight Celebration" with various competitions like essay competitions, noting and drafting, handwriting competitions, dictation, and translation competitions, etc. are conducted. The employees from our institute participated in the competitions and awards were distributed in the closing ceremony. The chief guest of the closing ceremony was Ms. Rohini S, Assistant Director (OL), Office of the Accountant General, Trivandrum. During the closing ceremony, SCTIMST Hindi Magazine 'Chitralekha' (July – December 2022) was released.



- The institute also participated in Town Official Language Implementation Committee (TOLIC) meetings regularly. TOLIC has announced their Official Language Awards 2021-22 for best OL performance. 'Chitralkha', the 'In House Hindi Magazine' of SCTIMST, has been selected for special mention. The Institute members participated in the various competitions conducted by TOLIC during the Rajbhasha Parv 2022-23.

◆ **Swachhta Pakhwada**

- Swachhta Pakhwada Campaigns were conducted during 01-05-22 to 15-05-22. A talk on 'Energy Conservation for Our Daily Life' by Er. Aneesh Rajendran, Energy Management Centre, Kerala was conducted on 10th May 2022. A poster competition on "Hygiene and Sanitation" and an exhibition of products made from scrap material "Scrappy Ideas-Do It Yourself 2.0" was conducted on 9th May 2022.

◆ **Observing International/ National Days and Weeks**

The Institute is always keen to commemorate International/National Days and weeks, in order to promote awareness. The following events were organized during the year.

World Parkinson's day - 11 April 2022

World Hand Hygiene Day - 5 May 2022

Cyber Jaagrookta Diwas celebration - 02 June 2022

World Heart Rhythm Week celebration - 9 June 2022

World Blood Donor Day - 14 June 2022

International Day of Radiography - 14 November 2022

World Antimicrobial Awareness Week -18 to 24 November 2022

National Voluntary Blood Donation Day - 1 October 2022

Epilepsy Awareness Purple Day 29 - March 2023

International Sleep Day - 17 March, 2023

◆ **Scientific presentation in Conferences by Faculty and Students: 320**

◆ **Number of Conferences/Workshops organized by the institute: 48**

AWARDS/HONOURS

- ◆ Dr Roy Joseph, Ms Gopika V Gopan and Dr Jayadevan E R received 11th National Petrochemicals Award from the Minister of State for Chemicals & Fertilizers and New & Renewable Energy, Shri. Bhagwanth Khuba for their invention, 'Metal-free radiopaque polymeric material for the embolization of arteriovenous malformation of brain'.
- ◆ Dr Debasish Gupta, Professor, Transfusion medicine received the Lifetime Achievement Award from the Indian Society of Blood Transfusion Immunohematology.
- ◆ Dr Jeemon P, Additional professor, AMCHSS received the 'LMIC (Lower- or Middle-Income Country) Investigator Award', from the International Behavioural Trials Network (IBTN) and University of Montreal, Canada.



- ◆ Dr Jeemon P, Additional professor, AMCHSS was Nominated as Advisory board member: World Health Organisation Global Health Foresight Horizon Scan Exercise.
- ◆ Dr Rakhal Gaitonde, Professor, AMCHSS joined as a member of the Lancet Citizens Commission.
- ◆ Dr Rakhal Gaitonde, Professor, AMCHSS joined as an expert to endorse the activities of the Alliance for Health Policy and Systems Research by the WHO.
- ◆ Dr Sowmya Remanan, Additional Professor CVTS, became a Fellow of European Board of Cardiothoracic Surgeons (Congenital Cardiac Surgery), from June 2022.
- ◆ Expertscape, an international agency from the USA placed SCTIMST as the 8th best institute in the world based on its contributions to clinical, academic, and research work in areas of cardiac rhythm disorders.
- ◆ Awards won by Faculty, Students, and Staff in conferences: 85

REVENUE GENERATED BY THE INSTITUTE

- Revenue generated by the Institute by way of Hospital Services and Testing Charges during the current financial year (2022-23) was Rs 115.81 Crore, which is 44 % of the DST`s grant-in-aid utilized during the year.
- The Institute has a balance of Rs 15 Crore under the Emergency Reserve Fund, which was created out of patient care income of previous years.

FINANCIAL SUPPORT FROM THE DEPARTMENT OF SCIENCE AND TECHNOLOGY

- Total grant sanctioned by the Department of Science and Technology through Treasury Single Account (RBI, New Delhi) for FY 2022-23 was Rs 335.00 Crores (as against Rs 335.01 Crores received for FY 2021-22).
 - Revenue Grant: Rs 305.00 Crores
 - Capital Grant: Rs 30.00 Crores

Institute utilized grant in aid of Rs 262.57 crores.

- Total Extramural Research (EMR) funding received by the Institute from Government Agencies, Non-Governmental Agencies and International Agencies during 2022-23: Rs 11.82 Crores.
- DST and SERB Contribution towards EMR funding
 - Funding for Ad hoc Research projects: Rs. 90.28 Lakhs. Besides Project funds were utilized through Zero Balance Subsidy Accounts (ZBSA) for the specified DST schemes.
 - Total number of ongoing research projects funded by DST and SERB was 30 numbers, out of which 5 numbers were initiated during 2022-23.

The institute places on record its deep sense of gratitude to the Department of Science and Technology for its unwavering support at all time.



Winners of SCTIMST Awards 2022 Instituted for Staff on Annual Convocation - May 21, 2022



Dr Harikrishnan S, Professor, Department of Cardiology, won the 'Prof M S Valiathan Award for Outstanding Research Investigator 2022'. The award was received by Dr K M Krishnamoorthy on behalf of the winner.



Dr Manjula P M, former PhD Scholar, won the 'Best Paper Publication Award 2022'.



Mr Sarath S Nair, Engineer E, Division of Extra Corporeal Devices, BMT Wing, won the 'Best Biomedical Technology Innovation Award 2022'.



Dr Anoop Kumar T, Scientist G, BMT Wing won the 'Letter of Merit for the Biomedical Technology Innovation'.



Dr Jeemon P Associate Professor, AMCHSS, won the 'Best Public Health Research Award 2022'



Dr Anju R, MPH Graduate (2019-21 batch) won the 'K Mohandas and Richard A Cash Award' for the Best Graduating Student of MPH batch. The award was received by Dr Sankara Sarma on behalf of the winner.



Winners of Certificate of Excellence 2023 Institute Day & National Science Day Celebrations February, 2023



Dr Jayadevan E R, Professor

Category: Professor (Senior Grade) & Professor



Dr Amita R

Category: Associate Professor



Dr Jayanand Sudhir B

Category: Additional Professor



Dr Jayasree R S, Scientist G

Category: Scientist/Engineer G (Senior Grade) & Scientist/Engineer G



Dr Jeemon P

Category: Associate Professor



Dr Lynda V Thomas, Scientist F

Category: Scientist/Engineer F





Mr Subhash N N, Engineer C

Category: Scientist / Engineer C



Dr Kakarla Saikiran, PDF

Category: MD/DM/MCh/PDF Residents



Dr Shani S D, Sr. Nursing Officer

Category: Nursing Staff



Mr Ajish Chandran, Executive Assistant

Category: Administrative staff and all other categories of permanent employees



Dr Manju Mohan P, Speech Therapist

Category: Medical Social Worker/ Physiotherapist/other paramedical staff



Ms Soumya Krishnamoorthy

Category: Administrative staff and all other categories of permanent employees



Ms Gopika V Gopan

Category: PhD student





Prof. (Dr.) Sanjay Behari took charge as the Director of SCTIMST on 01.04.2022





The Annual Convocation function (38th Batch) of SCTIMST held on 21st May 2022





Inauguration of Alumni portal in the Convocation Events on 21 May 22



The Ayushman Bharat-PMJAY/KASP Kiosk inaugurated on 7th April 2022





Observance of the World Environment Day on 05.06.2022 as a part of Azadi Ka Amrit Mahotsav



An MoU between SCTIMST and IIST

Signing of the Memorandum of Understanding between Sree Chitra Tirunal Institute for Medical Sciences and Technology, Trivandrum and Indian Institute of Space Science Technology, Trivandrum on 30th May, 2022 by the Director, Dr. Sanjay Behari (SCTIMST) and Dr. Sam Dayal Dev (IIST). The MoU will facilitate academic and research collaboration between the Institutes



Observance of the World Hand Hygiene Day on 5th May 2022



The 'World Heart Rhythm Week' was observed during 6-12th June, 2022 with the theme 'Know Your Pulse'. The program was organized by Department of Cardiology and Nursing Service Division





Dr. Sanjay Behari, Director, SCTIMST, hoisting the National Flag in the event of 76th Independence Day Celebrations 2022



Celebration of the 131st Ambedkar Jayanthi on 27th August 2022





Cardiology awareness program was conducted at Kumarapuram Upper Primary School on 30th September 2022



Observance of the World Alzheimer's day on the 22nd Sept 2022





The training program on “Data Analysis and Spatial Epidemiology using R - Hands on Training for Health Professionals” was conducted during 6-10 December 2022 in AMCHSS



Signing of the technology transfer agreement for the product “Drug Eluting Bioactive Calcium Sulfate Cement” with M/s Onyx Medicals, Meerut, on 13th September 2022



The Institute organized a Musical Rendezvous with the celebrity singer Smt. K. S. Chitra, as a part of Azadi Ka Amrit Mahotsav celebrations on 20.08.2022



Hindi Cell organized Hindi Fortnight Celebration from 19.09.2022 to 06.10.2022





The Department of Transfusion Medicine celebrated National voluntary Blood Donation Day 2022 by honoring voluntary Blood Donation camp organisers, blood donors and award winners on October, 2022



Royal Family Collection (a collection of books published by the erstwhile ruling family of Travancore) in the library was inaugurated on 11th October 2022 by Travancore Royal Family member Her Highness Aswathy Thirunal Gouri Lakshmi Bayi



G Parthasarathi Oration of 2022 was delivered by Prof Ashutosh Sharma on 17th October 2022





A Conclave on “Medical Devices Translation and Vision towards 2047” has been organized during 17th - 18th October 2022





World Radiology Day Celebrations, 14th November 2022



World Antimicrobial Awareness Week 2022 (18-24 November 2022)





Inauguration of the Combination Devices Block and unveiling the plaque by Dr Jitendra Singh, Minister of State (Independent Charge) of Science and Technology on 15th November 2022



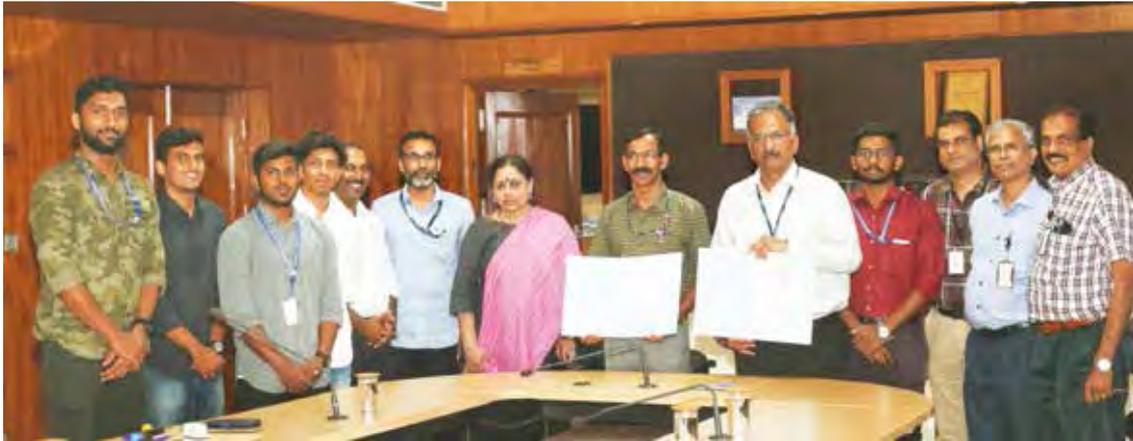


Inauguration of “Smrithi Vanam” and Butterfly Garden, in the Satelmond Palace Campus, Poojapura, on 30th November 2022.



The final function of Commemoration of PoSH Act, held on 9th Dec 2022





Signing of Memorandum of Understanding between SCTIMST, Government Engineering College Barton Hill, Trivandrum, and GESCO Healthcare Pvt Ltd, Chennai, on 24th January 2023



Dr Sanjay Behari, Director, SCTIMST, hoisting and saluting the National Flag in the event of 74th Republic Day Celebrations on 26th January 2023





The final function of Commemoration of PoSH Act, held on 9th Dec 2022



Signing of Memorandum of Understanding between SCTIMST, and University of Kerala, Trivandrum, on 27th February, 2023. The MoU is intended to promote research collaboration between the Department of Neurosurgery, SCTIMST and Department of Geology, University of Kerala, in the field of Moyamoya disease epidemiology





National Science Day 2023 and Institute Day of SCTIMST were celebrated on 28th February 2023. The Chief Guest was Dr G Madhavan Nair, former Chairman of Indian Space Research Organisation, and Secretary to Department of Space, Govt. of India





International Women's Day 2023 was conducted in the Institute on 8th March 2023



Inauguration of Heart in Pregnancy Clinic by Ms. Tinku Biswal IAS, on 15th March 2023.





Epilepsy Purple Day celebration on 20th March 2023 at the R Madhavan Nayar Center for Comprehensive Epilepsy Care (RMNC).



The meeting of the parliamentary committee of official language implementation was hosted by SCTIMST in Trivandrum.





HOSPITAL WING

HOSPITAL ADMINISTRATION

Hospital administration of the institute includes the office of the Medical Superintendent and other departments, which support patient care services.

Activities

The unprecedented disruptions and challenges due to the COVID-19 pandemic started easing from 2021-22. There was a fall in the patient volume across the hospital departments and services in the year 2020-21. The hospital volume in the previous two years indicates that it is gradually returning to the pre-COVID status. The annual statistics of the hospital services in the year 2022-2023 is provided below (Figures 1 to 10).

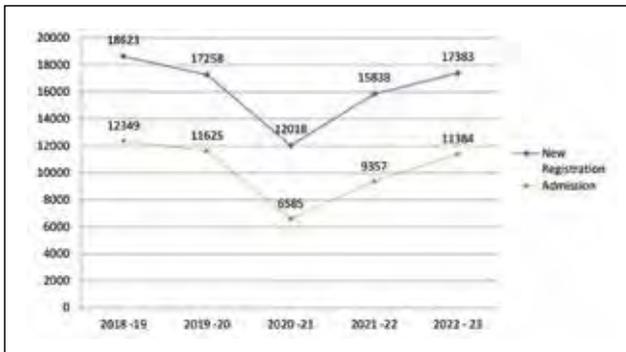


Figure 1: Trend in new registrations and admissions at SCTIMST

During the year 2022-23, the Department of Cardiology, Neurology, Cardiac Surgery, Neurosurgery and Imaging Sciences & Interventional Radiology in total registered 17383 new patients; which was 9.6% higher than the previous year. The trend is upward since 2020-21, when the pandemic peaked. In the year 2022-23, there was a 26.8% increase over the previous year. However, the numbers are yet to reach the pre-COVID levels. The number of patients for new registrations, new admissions and review cases are 7.1%, 8.5% and 4.5% less than the pre-COVID levels, respectively.

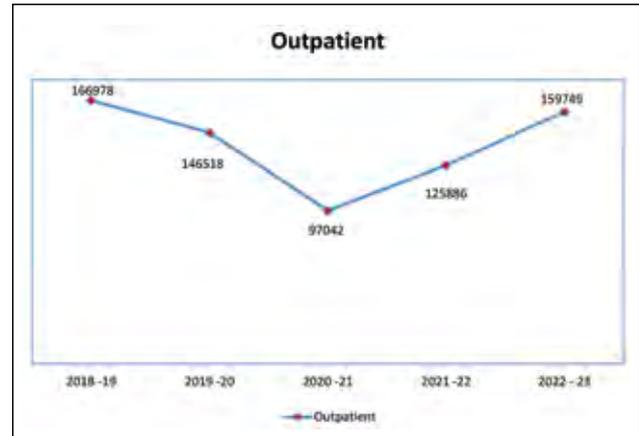


Figure 2: Trend in outpatient visits for follow-up (review) at SCTIMST

The sex-disaggregated data for outpatients (new registrations) and inpatients across various departments for the year 2022-23 are given in Figures 3 and 4.

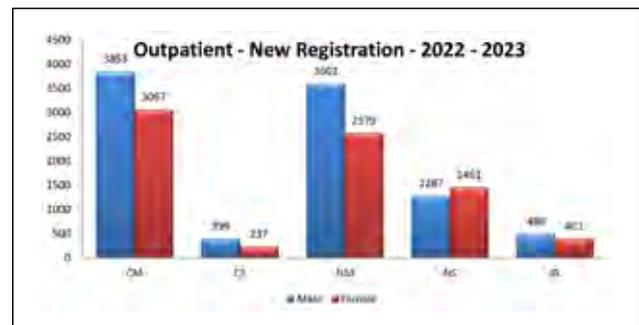


Figure 3: Sex disaggregated data – New registrations in the year 2022-23. CM- Cardiology, CS –Cardiac surgery, NM- Neuro medicine, NS Neurosurgery IR- Interventional Radiology



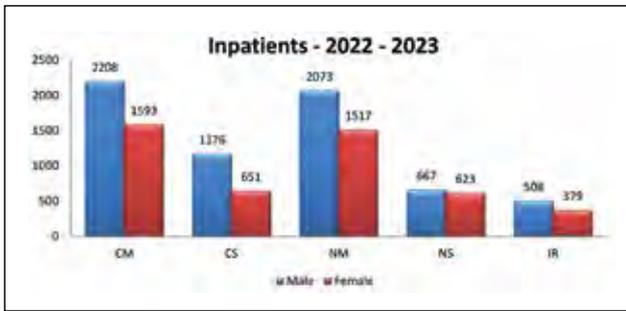


Figure 4: Sex disaggregated data – Patients admitted in the year 2022-23. CM- Cardiology, CS –Cardiac surgery, NM- Neuromedicine, NS Neurosurgery IR- Interventional Radiology

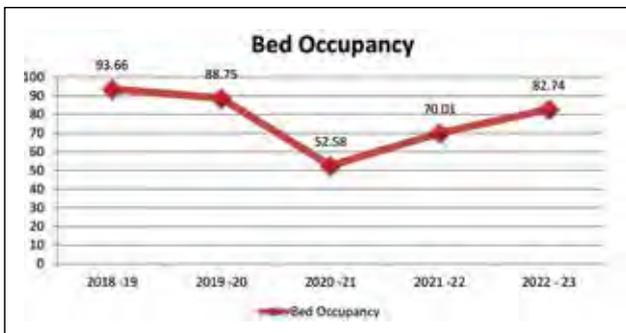


Figure 5: Bed Occupancy Rate at SCTIMST

Like the number of outpatients and admissions, COVID-19 pandemic significantly affected the bed occupancy rate at SCTIMST (Figure 5). From the large reduction during the peak of the COVID times, the bed occupancy rate increased over the last two years; from 70.0% in 2021-22 to 82.7% in 2022-23.

Free and subsidized treatment for patients at SCTIMST

During 2022-23, the Institute provided free treatment (A category) to 1.4% of its inpatients and subsidized treatment (A1 & B category) to 42.2 % of its inpatients based on their socio-economic categories as per the criteria of SCTIMST. The figures for free treatment and subsidized treatment for the outpatients were 0.5% and 36.4%, respectively (Figures 6 and 7).

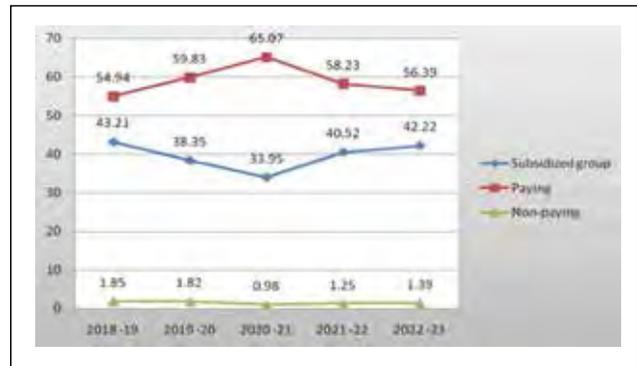


Figure 6: Trends in the proportion of patients in the paying, non-paying and subsidised treatment categories – inpatients

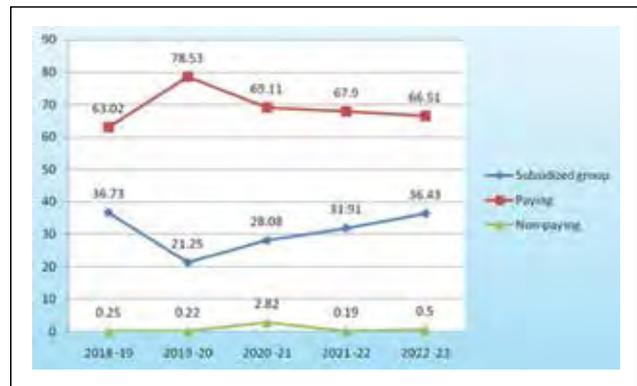


Figure 7: Trends in the proportion of patients in the paying, non-paying and subsidised treatment categories – outpatients

Ayushman Bharat Pradhan Mantri Jan Arogya Yojana/ Kerala Arogya Suraksha Padhathi (ABPMJAY/KASP) was the main beneficiary scheme implemented in the institute in the year 2022-23. A total of 4263 admissions were processed under this scheme. The department wise split up of the ABPMJAY/KASP and non ABPMJAY/KASP patients who were admitted in the year 2022-23 are indicated in Figure 8.



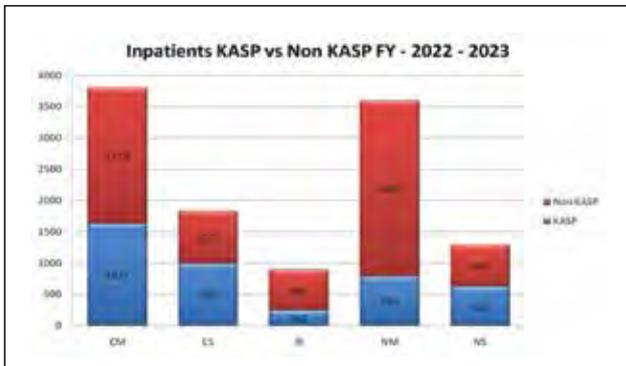


Figure 8: Department-wise split up of ABPMJAY/KASP & Non ABPMJAY/KASP – inpatient beneficiaries. CM- Cardiology, CS –Cardiac surgery, NM- Neuromedicine, NS Neurosurgery, IR- Interventional Radiology

Bed turnover rate

The observed mean bed turnover rose 21.6% from 37

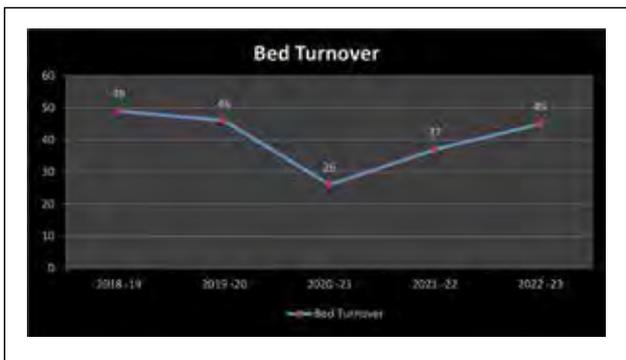


Figure 9: Trend in the Bed Turnover Rate at SCTIMST

patients/bed/year in 2021-22 to 45 patients/bed/year in 2022-23 (Figure 9)

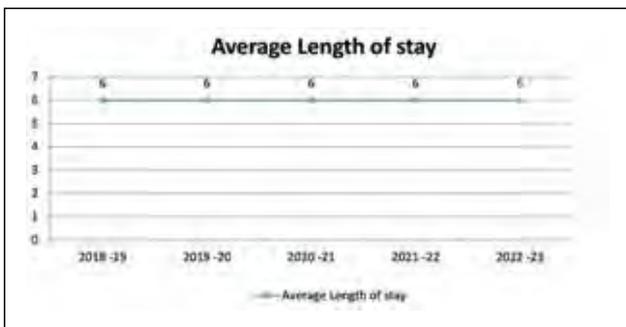


Figure 10: Average length of stay at SCTIMST

Average length of stay at the hospital

The average length of stay at the hospital remained same as 6 days throughout the last five years.

Medical Social Work Division

Medical Social workers deployed in the general pool and the various clinical departments provide services to patients, caregivers and family members to help them cope with the emotional and social responses to illness and treatment and minimise the negative impact of illnesses and hospitalisation. The social workers offer a unique contribution to the hospital system to meet the multidimensional needs of patients and their families and are a crucial group in the multidisciplinary team involved with patient care services. The team routinely carry out the socio-economic assessment of the patients, psychosocial assessment and provide counseling services. Medical social workers organize health education sessions for patients and bystanders regularly, provides information about the social and financial assistance schemes, coordinates the special clinics and the beneficiary schemes like AB PMJAY and RAN and also assists in treatment plans in collaboration with the clinical departments.

Pharmacy

Pharmacy department deals with the procurement, storage, dispensing and distribution of medicines to all patients admitted for medical and surgical correction at SCTIMST. The department provides the specifications of drugs, prepares indents for purchase of drugs, and maintains records and proper storage and monitoring of expiry date of all medicines. They oversee the distribution of medications such as transfusion fluids, parenteral fluids and other medicines to the inpatients of all the departments.

In addition, drugs and medications are dispensed to the permanent staff and their dependents based on the prescriptions from the staff doctor. Total number of receipt vouchers prepared for the staff pharmacy was 70 with a value of Rs. 16, 11,117.

In the year 2022-23, as per the indents prepared by the pharmacy department, a total number of 1177



receipt vouchers worth Rs. 10,06,37,306 were prepared. Total number of issue vouchers prepared by the pharmacy was 7010. In the year 2022-23, 902 paediatric prescriptions were handled. Patients admitted under the Ayushman Bharat Pradhan Mantri Jan Arogya Yojana/Kerala Arogya Suraksha Padhathi (ABPMJAY/KASP) were issued medicines for 15 days at the time of discharge as per the memorandum of understanding; 1897 patients were provided drugs worth Rs. 4,40,113.

Patients belonging to lower socio-economic categories are provided free drugs from the 'patient welfare fund' generated by the donations of the staff of SCTIMST and others. During the year 2022-23, 721 patients were provided with drugs worth Rs. 2,62,254 from this fund.

The department also offers one year training programme for young pharmacists. Pharmacists also educate patients as well as care providers regarding administration and safe use of medicines to paediatric patients as per need.

Dietary

Dietary department maintains high standards of hygiene and quality and serves nutritious diet to all the in patients in the hospital. Food menu is prepared based on a daily assessment by the dieticians of the individual needs and therapeutic requirements of the patients. It is a 24X7 service and provides three major and three small meals daily. Daily ward rounds are carried out by the dieticians to ensure that the needs of the patients are assessed and met. Nutritional assistance in terms of diet counselling is provided to inpatients being discharged from the hospital and their caregivers as well as outpatients who require them. In the year 2022-23, 62938 patients were provided diet in total including Ryle's tube feeding and semisolid diets. During this period, the dietary department also provided diet for 1740 bystanders of patients who were admitted for Video EEG and DBS.

Diet calculation and supply was made for 89 in-patients who needed Ryle's tube feeding and dietary assessment of 162 outpatients were carried out and were provided information on the ketogenic and other

special diets that they required.

Training and skill building of the dietician trainees related to the dietary management as well as the recent advances in the field is also carried out in the department throughout the year.

Laundry

The laundry section of the hospital plays a key role in ensuring the infection control in the hospital. The total quantity of linen pieces processed in the year 2022-23 in the laundry was about 375,000 Kg and the total number of items ironed in the laundry was about 180000; including that of patients and staff. The laundry section receives used linen from all the sections of the hospital including the wards, theatres, outpatient departments, intensive care units, procedure rooms and theatres. The soiled and infected linen were processed separately and with special care. The purchase of most of the chemicals used in the laundry were done through GeM portal in the past year.

Central Sterile Supplies Department

CSSD is the critical service unit that processes, issues and controls the sterile supplies to all the departments including the theatres and ICUs. The department receives the unsterile linen, instruments, equipment and stores from all the consumer departments of the hospital and processes them. It plays a crucial role in the infection prevention and control and patient safety. The total units processed by the department in the year 2022-23 are as follows:

WARDS

Items	Yearly
Chest Dressing Tray	21935
Suture Removal Tray	18250
Neuro Dressing Tray	9125
Catheterisation Tray	10220
Suture Tray	6570
Tracheostomy tray	1825



Muscle biopsy	1095
Cannulation Tray	730
Lumbar Puncture Tray	8760
Linen Bundle	10950
CSSD gowns	3650
Drape set	5475
Drum wards	10950
Basin bundle	3285
Anaesthesia Tray	3285
Empty Tray	4380
OT Catheterisation Tray	6570
Ordinary basin set	2920
Cheatle forceps	5840
ICD Bottle	2555
Dressing packing material	6250

PSOT

Items	Yearly
PSOT Instruments	3285
Bundle	5110
Drum	2920
Basin Set	5110
Other Items	5475

CATH LAB

Items	Yearly
Cath lab Instruments	3285
Bundles	21900
CAG Basin	8030
Drums	3650

DSA LAB

Items	Yearly
Instruments Sets	1825
Bundles	6205
Basins	5475
Drums	2555
Trays and other Items	5110

CARDIAC SURGERY THEATRE

Items	Yearly
Instruments	5110
Skin Towel	25650
Bundles	10950
Drums	9125

NEURO SURGERY THEATRE

Items	Yearly
Instruments Set	4380
Basin set	5110
Bundles	10950
Drums	7300

Steam sterilisation (Medical Block)

Medical block: 5 loads daily and the total loads in the period 2022-23 was 1825.

Surgical block: 10 loads daily and the total loads in the period 2022-23 was 3650.

Plasma sterilisation:

Around five loads per day were processed and the yearly load for the year 2022-23 was 1825.

ETO sterilisation:

About 4 loads per week were processed and the total number of loads in the last year was 210.



Activities

A new web portal was launched on 02/11/2022 at SCTIMST to enable convenient and easy access to hospital services including follow up services. It is a self-service web platform that will aid the patients to submit requests for new registrations, review appointments, download discharge summaries, investigations etc. The portal also enables telephonic and video consultations (<https://patientportal.sctimst.ac.in>).

A press conferences were held on 03/11/2022 at the Conference room, Office of the Medical Superintendent regarding the launch of the new web portal.

International rural women's day was celebrated on October 15, 2022 under the aegis of the 'Gender advancement for transforming institutions' (GATI) scheme of the Department of Science and Technology, Government of India and Department of Women and Child Development, Government of Kerala. A program was organized at the Dr Ambedkar Vidyaniketan CBSE Model Residential School, Njaraneeli, Thiruvananthapuram district which is the only CBSE School for tribal students under the Scheduled Tribes Development Department, Government of Kerala. Dr Rupa Sreedhar, Medical

Superintendent and chairperson, GATI, SCTIMST delivered a talk on healthy diet and lifestyle for adolescents and Dr Jayasree R S introduced the fields of Science, Technology, Medicine and Mathematics (STEMM). A medical camp was also organized under the leadership of Dr Karthika Ajit, Dr Sayoojya Sachithanandan and Ms Smita A S, Assistant Nursing Superintendent.

Events organised

International Yoga Day was celebrated in the institute on 21st June 2022.

76th Independence Day celebrations were held in the hospital wing on 15 August 2022

73rd Republic Day celebrations were held on 26 January 2023 in Hospital wing. The event was marked with flag hoisting and an address by the honorable director.

World Environment Day was celebrated on 5th June 2023 with fervor under the aegis of the 'Azadi ka Amrit Mahotsav'. The event was inaugurated in the hospital by the director, Prof. Sanjay Behari and Tulsi plants were handed over to student volunteers of the Youth Red Cross unit and staff members of SCTIMST to initiate a 'Tulsivan Ayush Udyan'. Director gifted tree saplings to Dr Harikrishna Varma, Head, BMT wing and team to start an urban forest project area in the BMT campus.

Staff

Department	Name	Designation
Hospital Administration	Dr Rupa Sreedhar	Medical Superintendent
	Dr Krishnakumar K	Associate Medical superintendent
	Dr Manju Nair R	Administrative Medical Officer (From 17/9/2021)
	Ms Archana Rajan D A	Asst. Administrative Officer (OMS) – A



Nursing Services	Ms Nirmala M O	Nursing Superintendent
	Ms Hepzibah Sella Rani J	Deputy Nursing Superintendent (up to 31.05.2022)
	Ms Smitha AS	Assistant Nursing Superintendent DNS in charge from 01.06.2022 to 24.01.2023)
	Ms Leena RK	Deputy Nursing Superintendent (from 25.01.2023)
	Ms Gracy MV	Assistant Nursing Superintendent
	Ms Anasooya R	Assistant Nursing Superintendent
Physical Medicine & Rehabilitation	Dr Jijo Varghese	From 25/11/2021
CSSD	Ms Sunila Raj	Senior Nursing Officer (Ward) (From 15.07.2022)
Infection Control Unit & Bio medical Waste Mgt	Ms Preethamol P	Infection Control Nurse (from 13.05.2022)
Construction Wing	Col. (Rtd) Vijayan Pillai K	Construction Engineer
Security & Safety	Mr Anil Kumar BS	Security & Safety Officer-B
Dietary	Ms Jyothi Lekshmy S	Dietician-B
Laundry	Mr Umesh Sankar S	Laundry Supervisor-B
MSW	Ms Rosamma Manuel	Scientific Officer & In-charge OPD services & Patient Management Services
	Dr Jiji TS	Medico Social Worker-A
Medical Records	Mr Sivaprasad R	Senior Medical Records Officer-A
Pharmacy	Ms Deepa K Nair	Senior Pharmacist
Transport	Mr Saji MS	Transport Supervisor

PHYSICAL MEDICINE AND REHABILITATION (PMR) DIVISION

The PMR Department offers rehabilitation services to the hospital wing of the institute. This includes physiatry and physiotherapy services. Rehabilitation is definitely a team effort and the well knit team at the department consists of a physiatrist and 7 physiotherapists. The physiatrist functions as the

department head and attends to rehabilitation consultations from in-patient and out-patient areas. Physiotherapists provide routine chest and limb physiotherapy to patients in the various wards and ICUs of the hospital wing. Out-patients and stable in-patients are brought to the department for specific therapy programmes and physical modalities. The facilities at the department includes advanced



rehabilitation machines (upper limb robotics, dynamic step trainer, balance trainer machine, walk assist machine, static cycler, tilt table etc), physical modalities (ultrasound therapy, TENS, FES, IFT, infra red, LASER etc) and gymnasium equipment. This year saw the physiotherapy services return to full swing as reflected in the surge in IP procedures.

Activities

Clinical Activities

Rehabilitation clinic of the institute is conducted by the physiatrist on Tuesdays, Wednesdays which serves to follow up patients with disability. Physiatrist is also a member of the multidisciplinary pain management group and attends the Friday pain clinic. Patients from speciality clinics like Fontan, movement disorder, neuromuscular, spine, stroke, memory clinic etc are routinely sent to the department for expert advice on rehabilitation. The patients are assessed in detail by the rehab team. Physiatrist (rehab physician) addresses the specific medical issues/complications during the rehabilitation period and medical/surgical/semi invasive/assistive technology options to improve the functional status of the patient are discussed. The physiotherapist delivers exercises and physical modalities to the patient. Exercises may

include strengthening, stretching, passive movement, mobilisation of stiff joints/tissues, clear chest secretions and specialised programs to improve gait, balance, breathing etc. Physical modalities include heat, cold, electricity, vibration etc which help to reduce pain and mobilise stiff joints.

Clinic	Out Patient Attendance
Rehabilitation clinic	8

Service Area	Procedure Count
In patient	22431
Out patient	2793

In-Patient Procedure Count Analysis

Procedure	Count
Exercise for single or multiple regions	7427
Respiratory therapy	14534
Physical modalities	90
Physiatrist consultation	31
Trigger point injections	3
Static cycling	98
Balance and gait training	39
Tilt tabling	209

Out-Patient Procedure Count Analysis

Procedure	Count
Exercise for single or multiple regions	1196
Respiratory therapy	1
Physical modalities	1417
Physiatrist consultation	96
Static cycling	54
Balance and gait training	21
Trigger point injections	4
Intra articular injections	3

Academic Activities

The internship program offered at the PMR department is much sought after by the BPT (Bachelor of Physiotherapy) interns. The interns are given training in the latest rehabilitation programs



Walk Assist Machine and Balance Training machine is use



and equipments. Regular classes and case discussions are conducted. The department also offers 1 year duration advanced certificate programme (ACP) in cardiovascular and neurological sciences.

Events/Achievements

- ◆ Dr Jijo Varghese attended state PMR conference REHABCON 2022 Thiruvananthapuram from 23/04/22 to 24/04/22 and presented on “Interventions in Sacroiliac Pain” as an invited speaker.
- ◆ Dr Jijo Varghese delivered a talk on “Gait retraining and physical exercises in elderly” on World Alzheimer’s Day contact program (September 2022) organised by Neurology department with live exercise demonstration by Ms. Jijimol George (staff physiotherapist) and interns.
- ◆ Cardiac rehabilitation initiated for patients from Fontan Clinic (pediatric cardiology division) at PMR department from September 2022 with evaluation, exercise/activities training by Dr Jijo Varghese and Ms Deepa G and team.
- ◆ Mr Amal MG attended the workshop “Myofascial trigger points and it’s management using neuromuscular techniques” at Bethany Hospital Thane as a resource person in September 2022.
- ◆ Mr Amal MG participated in a panel discussion on “How to check and treat diabetes” at All India Radio Trivandrum which was broadcast on 14/11/2022.
- ◆ Dr Jijo Varghese recorded a talk on “The rehabilitation of Cerebral Palsy patients” at All India Radio Trivandrum which was broadcast on 21/12/2022.
- ◆ Mr Amal MG took a class on “Integrated Neuromuscular Techniques” for physiotherapists as part of National Health Mission (NHM) training on 09/03/2023 at Thiruvananthapuram.



BPT Interns after tenure completion



Wheeled Mobility Device demonstration in Institute premises



Infra Red (superficial heating modality) in use



MEDICAL RECORDS DEPARTMENT

With the roll out of National digital health mission in the year 2020, most of SCTIMST hospital records were digitized and were made available in EMR format. In addition, all verified reports were made available to the patients in the personal health records format through SCTIMST patient portal.

By this the department empowered the patients with accurate information that enabled informed decision making, continuity in care, and patient centered management.

Activities during the year 2022 -2023

1. Processing patient registrations, admissions and maintenance of staggered appointment system.
2. Updating of socio-economic and sociological data related to patients as per the existing care.
3. Digitization of Medical Records and implementation of Electronic Medical Records.
4. Quantitative and Qualitative Analysis of Records and reporting of results.
5. ICD-coding and indexing of diseases and procedures and preservation of records.
6. Providing study materials and healthcare statistics for academic and research activities.
7. Collects the information from all departments and prepares statistics, which is useful for planning and organizing the hospital services.
8. Handling patient care-related correspondence and assisting tele-consultations.
9. Processing and issuance of various certificates, insurance claims and social security papers to patients.
10. Online reporting of overseas patients to Foreigner's Regional Registration Officer, and deaths to the Corporation of Thiruvananthapuram.

11. Printing, storage and supply of all Medical Records forms.
12. Conducting academic program in Medical Records Science.

New Initiatives during the year

1. MRD was instrumental in operationalizing the Ayushman Bharat is the Pradhan Mantri Jan Arogya Yojna or PM-JAY as it is popularly known; which is a flagship scheme of Government of India, started in the institute from 7th of April, 2023.
2. With the support from computer division all verified reports were made available in the personal health records format which can be accessed by the patient through SCTIMST patient portal.
3. New appointments and review appointments were integrated with patient portal and mobile app, a convenient, secure online patient access system.
4. The telemedicine services which were started with an aim to provide healthcare services to patients in their homes during the time of pandemic was revamped to make it a safe & structured video based clinical consultations between a doctor in a hospital and patients in the confines of their home.
5. MRD continued its effort for seamless integration of Medical Information across the hospital by maintaining timely, accurate and complete health records and ensuring safety and confidentiality of the information.

The statistics for the year are summarized in the Table below:



Activity	No.
New Registrations	17383
Admissions	11394
Reviews	141810
Bed Occupancy Rate	82.61%
Bed Turnover Rate	45 discharges/bed
Average Length of stay	6 days
Records released for study / research	23820
Certificates processed / issued	4409
Insurance Claims processed	1040
Records Scanned and uploaded	523989
Telemedicine Consultations	3890

Geographic Distribution of Patients

	Out Patient		In Patient	
	No.	%	No.	%
Kerala	13716	78.90%	9369	82.23%
Tamil Nadu	2954	16.99%	1523	13.37%
Karnataka	36	0.21%	19	0.17%
Andhra Pradesh	41	0.24%	37	0.32%
Maharashtra	48	0.28%	25	0.22%
Other States Of India	543	3.12%	401	3.52%
Outside India	45	0.26%	20	0.18%
Total	17383	100.00%	11394	100.00%

Staff

Mr Sivaprasad R, Senior Medical Records Officer & Central Assistant Public Information Officer (Patient Information)

Ms Susan Jacob, Medical Records Officer - C

Mr Christudas J, Medical Records Officer - B

Ms Manna George, Asst. Medical Records Officer

Ms Manju KK, Sr. Medical Records Assistant

Ms Asha Krishna RO, Medical Records Assistant - B

Ms Suma B, Medical Records Assistant - B

Ms Remya LT, Medical Records Assistant - B

Mr Ragesh DV, Medical Records Assistant - A

Ms Sandhya CK, Medical Records Assistant - A

Ms Suma KK, Medical Records Assistant - A

Ms Sreena T, Medical Records Assistant - A

Mr Sumesh PS, Medical Records Assistant - A



DIVISION OF NURSING SERVICES

The Nursing Services of SCTIMST strives hard with utmost dedication in realizing one of the key objectives of the Institute, namely, 'to provide and demonstrate high standards of patient care in advanced medical specialties.' The division has adopted the philosophy to maintain and excel in patient care through ongoing processes of caring, constant innovation, prevention of errors, and development of policies to maintain the qualities amongst the staff in all areas. The aim of Nursing service is to achieve excellence in patient care by planning and supervising patient-management services, providing a structured staff development program, serving as health educators and counsellors to patients and families, encouraging and facilitating the nurses for higher education and research, and keeping the employee morale by high by safeguarding the health and welfare of the employees. The Nursing Service division of SCTIMST functions as a non-academic division under the control of the Medical Superintendent. The Nursing Superintendent is the head of the division. Deputy Nursing Superintendent shares administrative responsibilities with the Nursing Superintendent. The other nursing personnel consists of Assistant Nursing Superintendent, Senior Nursing Officers (Ward and Operation Theatre), and Nursing Officers. Non-nursing staff includes Unit Helpers and Cleaning Attendants. The nurses take full responsibility for patient care without the assistance of family members. Total patient care model is adopted in this Institute. The division is considered a role model by nursing departments in various hospitals.

Workshops/conferences/events organized/participated

1. World Heart Rhythm Week celebration. 'Know Your Pulse'; organized jointly with the Department of Cardiology on 9th June 2022.
2. Training on Advanced Cardiac and Neuro critical care for Nurses, jointly organized with the Trained Nurses Association of India (TNAI) on 12 and 13 July 2022.
3. Webinar: Nursing Update on Heart Failure, jointly organized with the Department of Cardiology and Heart Failure Association of India on 23 July 2022.
4. Training program titled 'ECG interpretation for the Nurses'; jointly organized with the Department of Cardiology on 1st October 2022.
5. Training on Biomedical Waste Management, organized jointly with IMAGE, on 15th October 2022.
6. Conference on "Critical Care Nursing Paediatric Cardiac Nursing Updates (Step I), jointly organized with the departments of Cardiology and CVTS on 11th March 2023.
7. International Sleep Day program; jointly organized with Comprehensive Sleep Clinic, Department of Neurology on 17th March, 2023.
8. Total of 21 in-service educational/update program was organized in the Institute Auditorium-2 and 163 classes were taken by Nursing officers at each unit of the hospital.
9. World Hand Hygiene Day celebrated on 5th May 2022, with a display of posters in the patient waiting area in OPD, an evaluation of the best-maintained ward and ICU, a quiz competition, and an evaluation of steps of hand hygiene performed by staff and students.
10. As part of World Antimicrobial Awareness Week 2022, conducted Infection Control Link Nurse's Training Program on Clinical Audit and Role of Nurses in Healthcare Safety and Antimicrobial Stewardship on 19/11/2022.
11. Infection control link nurses' meeting conducted monthly with case presentations.
12. International Nurse's Week celebration at SCTIMST by the Nursing division with various sports, scientific papers & case presentations, and cultural programs by staff and family members on 14/5/2022.



13. Nursing Officers participated in various competitions arranged by State Nursing Council on International Nurses Week celebrations.



Figure 11: Clinical breast examination camp conducted on 08/1-/2022 by Snehitha Foundation organised by Nursing Service Division at SCTIMST.



Figure 13: Training programme for Nursing Officers on World Heart Day.



Figure 12: World Heart Day celebrations at Govt. Higher Secondary School, Medical college on 29/09-2022.



Figure 14: Antimicrobial Awareness week November, 2022

Community Services

Clinical Breast Examination camp conducted on 08/10/2022 in SCTIMST organized by Nursing Division in association with Snehitha Women's Health Foundation – 100 staff utilized the opportunity.

School health program on “cardiovascular disease



prevention – begins from Adolescence” was conducted for students of 10th and 11th standard in Govt Higher Secondary School, Medical College on 30th September. Classes were taken by Nursing Officers, Ms. Suma, Ms. Girija A., Ms. Swapna, and Ms. Savitha. Cardiovascular disease awareness posters were exhibited. Demonstration of Cardio Pulmonary Resuscitation (CPR) with Manikin was also done.

Awards and Honors

Ms Sarika Somaraj (N/O, CSICU) won 1st prize in the poster competition conducted in association with the Antimicrobial Awareness Week celebration at SCTIMST.

Dr Shani S. D. (SNO, NSICU) won first prize for the scientific paper presentation on the topic, ‘Social & Behavioral Factors associated with Stroke Recurrence in the International annual conference of Society of Critical Care & Emergency Medicine – Nursing Stream at Udaya Samudra, Kovalam, Organised by College of Nursing, Trivandrum from 25/11/2022 to 27/11/2022.

Mr Ridson Delo Louiz (N/O, NMW) won the 3rd prize in the elocution competition for staff nurses conducted by ANEI Kerala Chapter on 11th April 2022.

Best Nurse award SCTIMST 2022 - Ms. Saly John (NO, CHICU)

Clinical excellence SCTIMST won first prize for the neuro quiz - PG conducted at the conference organized by the Society of Indian Neuroscience Nurses at Agra from 9/12/2022 - 10/12/2022.

Mr Prajeesh P. Prakash, nursing officer won first prize for the neuro quiz - UG conducted at the conference organized by the Society of Indian Neuroscience Nurses at Agra from 9/12/2022 - 10/12/2022.

Staff

Ms Nirmala M O, Nursing Superintendent

Ms Leena RK, Deputy Nursing Superintendent

Ms Gracy MV, Assistant Nursing Superintendent

Ms Anasooya R, Assistant Nursing Superintendent

Ms. Smitha AS, Assistant Nursing Superintendent



Figure 15: Paediatric Cardiac Conference, 2023



DEPARTMENT OF ANAESTHESIOLOGY

The Department of Anaesthesiology of the Institute, through the divisions of Cardiothoracic and Vascular Anaesthesiology, Neuroanaesthesiology and Neurocritical care serves patients presenting with various cardiovascular, thoracic and neurological ailments.

DIVISION OF CARDIOTHORACIC AND VASCULAR ANAESTHESIOLOGY

Activities

Clinical Activities

The Division of Cardiothoracic & Vascular Anaesthesia is actively involved in the management of patients undergoing adult cardiac surgery, paediatric cardiac surgery, vascular and thoracic surgery, and cardiological and cardiac radiological interventions. Clinical services were rendered to patients in six cardiac surgical operation theatres, three catheterization laboratories, two DSA labs, two MRI suites and one CT scan room. Anaesthesiology teams were actively involved in providing intensive care services in the adult cardiac surgical ICU, paediatric cardiac surgical ICU and Coronary Care Unit.

The Anaesthesiologists shoulder responsibility of resuscitating patients admitted and undergoing interventional procedures or surgeries in the hospital. All healthcare providers in the hospital are assured a 365-day backup of the Anaesthesiology team when their patient is critically ill and needs urgent resuscitation. Through the Code-Blue program and Code-orange program, the Anaesthesiology team deliver emergency care within moments of in-hospital announcement or phone call. Expertise in ventilatory therapy and invasive cannulations was utilised by the Anaesthesiologists for the service of patients in the ICUs and for transporting critically ill patients.

Cardiothoracic & Vascular Anaesthesia is a progressive division that updates itself periodically in

the areas of monitoring technology and interventional procedures. Advanced monitoring consisted of 3D and 2D perioperative echocardiography, lung ultrasound, NIRS, fibre-optic bronchoscopy and anaesthesia depth monitoring. Anaesthesiologists routinely perform procedures such as neuro-axial anaesthesia, ultrasound-guided regional anaesthesia, lung isolation using double-lumen endobronchial tubes and bronchial blockers and percutaneous tracheostomies. Microprocessor-based ventilators with advanced modes of ventilation and display of curves and loops were available in the critical care armamentarium of the Division.

Chronic Pain and Geriatric Care Unit was run by the Division to alleviate suffering from chronic pain and geriatric diseases. The Cardiothoracic and Vascular Anaesthesiology Division dispensed perioperative care for the following surgeries and diagnostic and interventional procedures during the year:

Area	Number of surgeries/ Procedures
Adult Cardiac surgery OT	1389
Paediatric cardiac surgery OT	654
Cardiac catheterization laboratory	516
Cardiac electrophysiology laboratory	210
CT scan	87
MRI	10

Academic activities

The Cardiothoracic and Vascular Anaesthesia division conducted academic activities as a part of the curriculum and training of students. It involved bedside teaching, and organizing seminars, symposia, lectures, journal clubs, discussions on focused topics and clinical case scenarios. The resident doctors were



introduced to the recent advances in the subject such as published guidelines, meta-analysis, and Pro & Con topics. All 1st and 3rd Saturdays are dedicated exclusively to the Department's academic sessions and Wednesdays are for combined meetings between Cardiac Anaesthesia and Cardiac surgery. The academic sessions were conducted in the classroom and online.

Research Activities

Clinical and biomedical research activities and publications were conducted by faculty members and resident doctors throughout the year. Research projects received extramural and intramural funding.

Important projects are summarized below:

Ongoing projects

1. Femoral artery cannulation in the paediatric population; conventional versus ultrasound-guided; a single centre, prospective, randomized controlled trial. Ongoing, interim analysis done to present in IACTACON 2023 at Jodhpur in February (PI: Dr Thomas Koshy).
2. Comparison of efficacy of ultrasound-guided bilateral erector spinae plane block and transversus thoracic muscle plane block in paediatric cardiac surgeries via median sternotomy (PI: Dr Thomas Koshy).
3. Intraoperative acid-base changes with bolus administration versus continuous infusion of sodium bicarbonate during repair of the abdominal aorta (PI: Dr PK Dash).
4. Ultrasound-guided transverse thoracic muscle plane block and pecto-intercostal facial plane block for reducing postoperative pain in paediatric cardiac surgery (PI: Dr Shrinivas Gadhinglajkar).
5. Use of Videolaryngoscope to reduce complications of trans-oesophageal probe insertion in children (PI: Dr Thomas Koshy).
6. Role of new PaO₂ / FiO₂ ratio and static lung compliance in fast-tracking cardiac surgery (PI: Dr Subin Sukesan).

7. Comparison between inhalational and intravenous anaesthetic induction agents on echocardiographic parameters of mitral stenosis patients undergoing mitral valve replacement (PI: Dr P K Dash).
8. Comparison of cerebral and mesenteric NIRS for early detection of low cardiac output syndrome in paediatric cardiac surgical patients (PI: Dr Unnikrishnan K P).
9. Comparison of left ventricular ejection fraction obtained by 2D mitral E-point septal separation and 3DE mitral e-point septal separation linear and area methods with that of 2D and 3D volumetric methods using TOE (PI: Dr Shrinivas Gadhinglajkar).
10. Effects of Sevoflurane versus Propofol on mitral annular displacement evaluated using speckle tracking (PI: Dr Shrinivas Gadhinglajkar).
11. Comparative analysis of left ventricular longitudinal, regional, global, and circumferential strains between continuous intravenous infusions versus bolus dose of magnesium sulphate during rewarming given in patients undergoing CABG (PI: Dr Subin Sukesan).
12. Geriatric Pain CLINIC for Regenerative Services funded by Kusma Trust UK (PI: Dr Subin Sukesan).
13. Development of stance control knee ankle foot orthosis (SCKAFO) for knee instability management (Clinical PI: Dr. Subin Sukesan) in collaboration with the BMT wing.
14. Bioinspired total foot pressure off-loading device for diabetic foot ulcer management in geriatric population (Clinical PI: Dr Subin Sukesan) in collaboration with the BMT wing.
15. Device Development Biological Fluid component separator segregator SIIC -IIT-K Industry Phraction Scientifics. Funded by BIRAC (PI: Dr Subin Sukesan).
16. PRP Kit Product patent filing number 201941044213 and product under DR Renjith P Nair BMT Wing, prototype development ongoing (Clinical PI: Dr Subin Sukesan).



17. Platelet Concentrator and Segregator (The project is now being jointly done by SCTIMST and Phraction Scientifics Pvt. Ltd., PI: Dr Suneel P R).

4. Dr Saravana Babu completed Fellowship in cardiovascular anaesthesia and critical care at Toronto General Hospital, University of Toronto, Canada.

MOU signed

1. Phraction Scientifics & SCTIMST for device development translation 31st March 2022 (PI: Dr Subin Sukesan)
2. IIT-K & SCTIMST for collaboration research & device developments (Coordinator Dr Subin Sukesan)

Awards and Honours:

1. Dr Gayathri received the 1st Award for best paper presentation during TEEPGI 2023 at PGIMER Chandigarh. The topic was, "Left AV valve repair during Fontan procedure: role of intraoperative TOE."
2. Dr Divya Jacob won the 2nd award for paper presentation during TEEPGI 2023 at PGIMER, Chandigarh. The topic was, "Role of intraoperative trans-oesophageal echocardiography in diagnosing multiple level of obstruction at atrial level following Senning take down and arterial switch operation."
3. Dr Kartheek Hanumansetty was awarded 1st Rank in Fellowship of Trans Oesophageal Echocardiography, 2022.

DIVISION OF NEUROANAESTHESIOLOGY AND CRITICAL CARE

Neuroanesthesia division is involved in the perioperative management of patients with various neurological diseases for neurosurgical, neurovascular, and neurological interventional procedures, critical care of the above group of patients as well as involvement in diagnostic modalities like CT scans, Magnetic Resonance Imaging (MRI), Digital Subtraction Angiography, etc., that needs anaesthesia/critical care support. In addition, the faculty and residents of the division are also actively involved in the resuscitation of patients with cardiac arrest and other emergencies, intra and inter-hospital transport of the critically ill, acute pain management, infection control, and safe blood transfusion practices. The faculty are involved in teaching and academic activities of residents, students, clinical and biomedical research and biomedical device development. The members are actively involved in the participation and organization of conferences, public and social activities of the institute.



Figure 16: Signing MOU between IIT, Kanpur and SCTIMST, Trivandrum on 30th August 2022



Activities

Clinical Activities

Area	Number
Neurosurgery operating room	1350
Radiology Cath Lab	180
MRI suite	360
ACUTE STROKE	65 (MT) + ICH-BLEEDS
Neuro ICU (4)	1400
WARDS/OPD	Resuscitation, IV, LP, Consultations, Muscle Biopsy, CT, MRI

Research Programs

- Development of a Low-cost portable Defibrillator, funded by the DST (PI: Dr S Manikandan). The product has been developed and 'EOI' invited.
- Development of wearable advanced fall detection watch with a wireless alarm system for help activation. (Funded by the SERB, PI: Dr S Manikandan).
- Development of Indigenous point of care Transcranial Doppler (TCD) machine for patient management (Shortlisted for DBT funding, 2023, PI: Dr S Manikandan).
- Development of Intelligent Anti-drowning Wearable Gadget with Smart Buoyancy system (PI: Dr S Manikandan, shortlisted for funding by ICMR).
- Indigenous Anaesthesia Depth monitoring system using Brain Monitoring Technology (PI: Dr S Manikandan, joint project with CDAC-Trivandrum, NIT Trichy funding approved by DHR-ICMR).
- Non-opioid versus Opioid Perioperative Analgesia In Neurosurgery: A prospective Multi-centric Randomized Controlled Trial. (NO PAIN Trial) (PI: Dr S Manikandan, funded by ICMR).
- Development of non-invasive jugular venous saturation and carotid flow (Co-PI: Dr S Manikandan, funded by DST).
- Cognitive decline in elderly - a randomized controlled trial in patients with chronic subdural hematoma” in collaboration with Govt MCH, Thiruvananthapuram (CSRI program of the DST, PI: Dr Smita V).
- Development of a spinal cord stimulator for pain management (PI: Dr Ajayprasad Hrishi, funded by the Technical Research Centre of the DST).
- Design and development of a microdialysis set-up for cerebral applications (Co-PI (clinical): Dr Ajayprasad Hrishi, funded by the Technology Development and Transfer, DST).
- Comparison of Depth of Anaesthesia Indices (SNAP vs. Bispectral index) during Desflurane General Anaesthesia and Awakening in patients undergoing Interventional Neuroradiology procedures (PI: Dr Ajayprasad Hrishi, funded by Bellscura IIC)
- Evaluation of markers of cerebral oxygenation and metabolism in patients undergoing clipping of cerebral aneurysm under Propofol-based total intravenous anaesthesia versus Sevoflurane based inhalational anaesthesia: A prospective randomized pilot study (PI: Dr Ajayprasad Hrishi).
- A prospective observational study to evaluate serial Arterial lactate as a marker and predictor of delayed cerebral ischemia and poor outcome in patients with aneurysmal SAH (PI: Dr Ajayprasad Hrishi).
- Monitoring of cerebral oxygenation trends with near-infrared spectroscopy in patients undergoing therapeutic management of supratentorial arterio-venous malformation and evaluating its efficacy in detecting periprocedural complications and therapeutic prognostication- An observational pilot study (PI: Dr Ajayprasad Hrishi).
- Anaesthesiological Routine Care for Thrombectomy in Cerebral Ischaemia: An



International Prospective Observational Study (ARCTIC-I) (PI: Dr. Unnikrishnan P).

16. Craniovertebral junction anomalies: clinical and radiological outcome evaluation after surgical intervention (Co-I: Dr Ranaganatha Praveen).

New Initiatives

Dr Unnikrishnan P initiated the use of a checklist for the monitoring and management of patients presenting with Acute Sub Arachnoid Haemorrhage in the ICU, which can help in predicting the risk of complications associated with SAH and also help in ensuring the provision of uninterrupted key therapeutic interventions during their stay in the ICU.

Events Organized

1. Dr Unnikrishnan P. was an organizing committee member of Travancore Neurocon-2022, CME Program of NSI Kerala Chapter, Annual Conference 2022, conducted by the Kairaly Neurosciences Society, May 6-8, 2022, Kovalam, Thiruvanthapuram.
2. The division was involved in Organization and teaching activities of NICE 2022, October 2nd, 2022, SCTIMST, Trivandrum.

Awards and Honours

1. Dr Jeeva George won the first prize in the Quiz competition at the annual conference of the Neurocritical care society of India held in October in Hotel Pride Plaza, Gurugram.
2. Dr Sarath Surendran has won the second prize for a paper presentation at the annual conference of the Indian Society of Neuroanaesthesia and Critical Care (IS) held in Hyderabad, in January 2023.
3. Dr Ajayprasad Hrishi received Best Researcher Award, International Scientist Awards on Engineering, Science and Medicine, INSO Awards, April 2022.

Staff

Faculty

Dr Shrinivas V Gadhinglajkar, Professor (Senior Grade) and Head

Dr Thomas Koshy, Professor (Senior Grade)

Dr Prasanta Kumar Dash, Professor (Senior Grade)

Dr Manikandan S, Professor

Dr P R. Suneel, Professor

Dr K P Unnikrishnan, Professor

Dr Smita V, Additional Professor

Dr Subin Sukesan, Additional Professor

Dr Ajay Prasad Hrishi P, Additional Professor

Dr Unnikrishnan P, Associate Professor

Dr Ranganatha Praveen, Associate Professor

Dr Saravana Babu M S, Assistant Professor

Technical

Binu Thomas, Senior Scientific Assistant

Shibu V S, Senior Technical Assistant

Baiju Bavura S, Senior Technical Assistant

Tiny Babu, Senior Technical Assistant

Pradeep S L, Senior Technical Assistant

Sumesh T M, Senior Technical Assistant

Damodara Sarma E, Technical Assistant – B

Archana S, Technical Assistant – A

Manju R S, Technical Assistant - A



DEPARTMENT OF BIOCHEMISTRY

The Department of Biochemistry has three sections: (a) Research laboratories, (b) The Central Clinical Laboratory (CCL), and (c) the Molecular Genetics Unit (MGU). The research laboratories have been pursuing the molecular basis of disease processes affecting the vascular system leading to neurological and cardiovascular disorders. The main areas under investigation include, a) comparing mitochondrial function and dynamics in atrial tissue of patients undergoing cardiopulmonary bypass surgery and aortic valve repair, b) Exosomal microRNA and proteins in Parkinson's disease, c) Glucocerebrosidase assay development for the assessment of lysosomal dysfunction in Parkinson's disease, d) Role of S100 proteins in cardiac fibrosis.

The central clinical laboratory undertakes the laboratory diagnostics of the institute in areas of biochemistry, hematology, clinical pathology, amino acid analysis.

The molecular Genetics Unit (MGU) undertakes molecular testing including mutation/SNP using Sanger sequencing.

Activities

Clinical Activities

Central Clinical Laboratory (CCL)

Fully automated equipment used at CCL includes Dade-Behring/Siemens RXL, Aspen A1c HPLC Analyzer LD 500, Mindray 5-part Hematology analyzer-BC 5180 & BC 5000, Gem Premier 3000-ABG analyzer, CobasU 411(Roche) urine analyzer, and Amax Destiny coagulation analyzer. The Central Clinical Laboratory performed a total of 944815 investigations during the year-2022-23.

Item wise break-up of the tests performed during 2022-23

SI. No.	Investigations	Number
1	Arterial Blood Gas	20596
2	General Chemistry	431271
3	Hematology & Coagulation	333594
4	Clinical Pathology [CSE, Motion, Urine]	157263
5	Neurochemistry	2
6	Plasma Amino Acids	2089
Total Investigations		944815

Molecular Genetics Unit (MGU)

Sanger sequencing for single mutation/SNP is being performed during 2022-23 at MGNU.

SI. No.	Investigations	Number
1	Sanger sequencing	89
Total Investigations		89

Research Programs

Three research laboratories supervised by faculty members have been together training a total of 6 PhD students at various stages of their PhD. In addition, the MSc thesis work of 9 students and the apprentice training of one was also facilitated. The activities include laboratory research, regular and mandatory seminar presentations, and work progress presentations every Tuesday, facilitating mid-course comprehensive examinations and necessary PhD and MSc thesis supervision.



1. **Comparing mitochondrial function and dynamics in atrial tissue of patients undergoing cardiopulmonary bypass surgery and aortic valve repair**

This study aims to understand the difference between mitochondrial function and dynamics before the induction of cardioplegia and shortly after reperfusion in patients with and without ischemic cardiovascular disease. The right atrial appendage (pre and post-samples) excised during the cannulation of the heart surgery was used for the experiments like high-resolution respirometry and western blot. In high-resolution respirometry, substrates like palmitoyl L- carnitine and malate showed no difference in the mitochondrial state 2 complex I respiration in the post-sample when compared with the pre-sample obtained before the induction of cardioplegia. State 3 complex I respiration mediated by palmitoyl L- carnitine and malate in the presence of ADP in mitochondria of post-sample showed lower OCR when related to pre-sample mitochondria. Succinate-mediated state 3 complex I + II mitochondrial respiration was seen to be lowered in the post-sample compared to the pre-sample in the fatty acid + carbohydrate protocol. The western blot analysis of mitochondrial dynamics proteins like OPA1(mitochondrial fusion), DRP1 and MFF (mitochondrial fission) was done in some pre and post-samples. We got both long and short forms of OPA1, while an increased expression of S-OPA1 was seen in post samples indicating its role in bioenergetics. Increased expression of MFF was found in the post samples representing its role in the mitochondrial fission required during the

stress condition after reperfusion in heart tissue.

2. **Exosomal Protein profiling in Parkinson’s disease patients**

The objective of this study is to identify dysregulated exosomes isolated from Parkinson’s Disease patient’s blood. Towards this, A total of 286 plasma samples were collected from patients diagnosed with Parkinson’s disease and 100 healthy controls. The clinical and demographic details of the sample collected are shown in Table below.

After isolating the exosomes from the plasma, the Coomassie Blue Staining after SDS-PAGE and western blot with HSP 70 and TSG 101 were performed to check the quality (Figure 20).

Then, mass spectrometry was performed, and obtained a large number of different proteins when compared to controls. Currently, the validation of these proteins is being carried out.

3. **Glucocerebrosidase assay development of monitoring lysosomal dysfunction**

The objective is to develop a specific and sensitive biochemical assay for monitoring the lysosomal function in Parkinson’s Disease.

	Healthy Controls	PD patients
n (gender)	n=100 (57 M, 43 F)	n=286 (207 M, 79 F)
Age (range)	52.3±12.8	57.9±9.9
Age at onset (years)	-	7.2±5.1
MoCA	-	25.2±4.3
H&Y scale	-	2.04±0.78
UPDRS scale III	-	21.8±12.8

(PD = Parkinson’s Disease, N= total number of samples, M = male, F = female, MoCA= Montreal Cognitive Assessment, H&Y = Hoehn and Yahr scale, UPDRS = Unified Parkinson’s Disease Rating Scale)

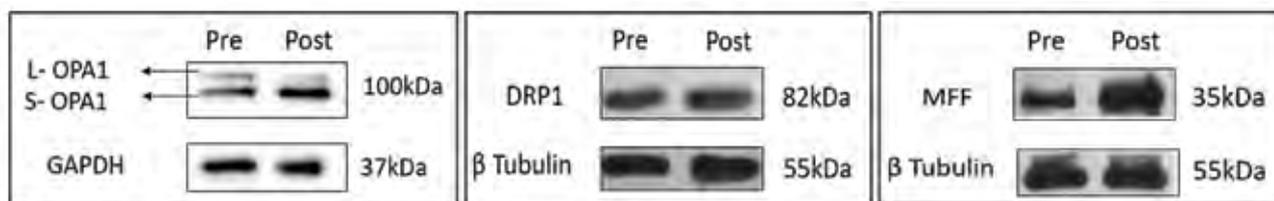


Figure 18: Western blot analysis of Pre and post cardiac tissue



A total of 101 plasma samples were collected from patients diagnosed with Parkinson's disease and 99 healthy donors. The results illustrated in **Table 2** indicate clinical data and glucocerebrosidase activity.

	CONTROLS	PD PATIENTS
N (Gender)	N=99 (57M,42F)	N=101 (75M, 26F)
Age	52.4 ± 12.8	59 ± 9.6
UPDRS Scale III	-	21 ± 12
GCase Activity	3.58 ± 2.20	1.32 ± 1.85

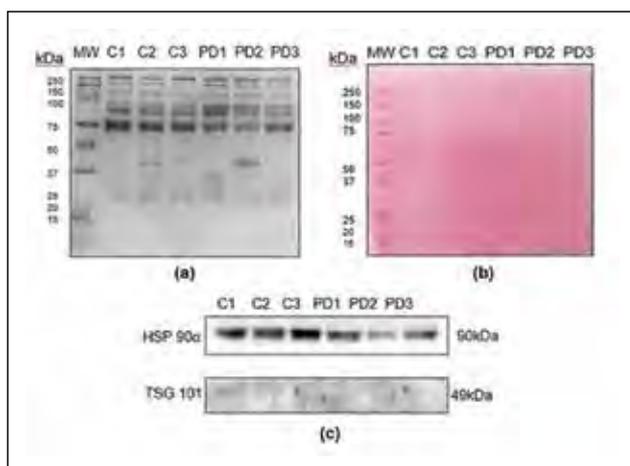


Figure 20: Characterisation of exosomes by SDS-PAGE and western blot. a) Coomassie staining of exosomal proteins. b) Ponceau S-stained image of membrane after western blot. c) Western blot image of exosomal protein markers, HSP90 and TSG101. MW: Molecular weight marker. C1, C2, C3 are healthy controls and PD1, PD2, PD3 are patient samples.

The mean ± SD of absolute glucocerebrosidase activity in PD patients was found to be 3.32 ± 1.85 nmols/ 10^7 WBC/hr and those of controls as 3.58 ± 2.20 nmols/ 10^7 WBC/hr.

4. S100 proteins and cardiac fibrosis

Heart failure has emerged as a global disease with age, diabetes and obesity identified as important risk factors. Even after identification of several molecular targets, only very few have been developed as therapeutic for heart failure. This study investigates whether the levels of S100 proteins in heart failure patients can be associated with the disease. The molecular mechanism of action of S100 proteins is also being studied using an in vitro model.

Events Organized

Biochemistry Talk – 2022: Organised an invited talk as part of the “Biochemistry talk” series by Dr. Poonam Thakur, Assistant Professor, School of Biology, Indian Institute of Science Education and Research (IISER), Thiruvananthapuram on 25th October 2022, 2.00 PM at Auditorium 2 (Block 2, Hospital Wing) on “Physiological Factors Driving Parkinson’s Disease”.



Figure 21: Biochemistry Talk by Dr. Poonam Thakur, Indian Institute of Science Education and Research (IISER), Thiruvananthapuram on October 2022



Students and faculty members of various departments attended the seminar. The seminar was conducted in a hybrid mode that enabled more participation of students and faculty members from outside the institute as well.

Staff

Faculty

Dr Srinivas G, Scientist G & Head

Dr Madhusoodanan U K, Associate Professor

Dr Cibin TR, Associate Professor

Technical

Jayasree KK, Scientific Officer (Lab)

Dr Geetha M, Scientific Officer (Lab)

Prem Mohan M, Sr. Technical Assistant (Lab)

Deepa K Raj, Sr. Technical Assistant (Lab)

Sreeja KR, Sr. Technical Assistant (Lab)

Dr Deepa D, Technical Assistant (Lab)-B

Sarath Kumar R.S, Technical Assistant
(Animal Lab)-B

Susan Mani, Technical Assistant (Lab)-B

Hima VM, Technical Assistant (Lab)-A

Saritha Gopakumar, Technical Assistant (Lab)-A

Siju KS, Technical Assistant (Lab)-A

Divya T Nair, Technical Assistant (Lab)-A

Anooja V, Technical Assistant (Lab)-A

Mangalamma H.R, Technical Assistant (Lab)-A



DEPARTMENT OF CARDIOLOGY

The Department of Cardiology has three divisions.

- ◆ Division of Adult cardiology and interventions
- ◆ Division of cardiac electrophysiology
- ◆ Division of Paediatric Cardiology

Division of Adult cardiology and interventions

The division of adult cardiology and interventions offers its expertise in risk stratification, prevention, and comprehensive management of a wide range of coronary and non-coronary cardiac ailments. The patients presenting to the Outpatient Department are evaluated clinically along with basic non-invasive investigations on the same day with the formulation of a management strategy.

Clinical Activities

In addition to the routine OP clinics, the division runs the Heart Failure clinic weekly and the Interventional Cardiology clinic twice weekly. The division offers evaluation and state-of-the-art management of all types of coronary and structural heart interventions and stays as a referral centre for the region.

Non-invasive testing

- ◆ Echocardiography including advanced echocardiographic methods like trans-esophageal echocardiography, tissue Doppler imaging, strain, speckled tracking, and 3D echocardiography (trans-thoracic and trans-esophageal). Currently, there are five echocardiography machines available in the Department of Cardiology.
- ◆ Stress testing-tread mill exercise electrocardiogram and Dobutamine stress echocardiography.

Invasive Diagnostic facilities

- ◆ Diagnostic cardiac catheterization and angiography: The department has two cardiac catheterization laboratories installed presently,

where various diagnostic and interventional cardiac catheterizations are undertaken. Digital subtraction angiography is also available for the imaging of vascular structures.

- ◆ Intravascular Ultrasound imaging for anatomical evaluation of coronary stenosis and optimization of coronary stenting.
- ◆ Optical Coherence Tomography assessment of coronary lesions, used routinely to assess coronary plaque characteristics and decision-making in management.
- ◆ Coronary physiology for functional assessment of coronary lesions: Hyperemic (FFR) and Non-hyperaemic indices (RFR, iFR) are routinely undertaken).
- ◆ Intra-cardiac echocardiography is used to aid in device closure of atrial septal defects.

Interventional cardiovascular procedures

- ◆ Percutaneous coronary interventions include both emergent and elective, including advanced interventions with Rotational atherectomy support. The procedures are guided by physiological evaluation and imaging by OCT and IVUS.
- ◆ Percutaneous balloon valvotomies (Mitral, aortic and pulmonary): One important therapeutic procedure we do is balloon mitral valvotomy in pregnant women, which is supported by SAT Hospital Medical College.
- ◆ Percutaneous closure of Atrial septal defects, Patent Foramen Ovale, Ventricular septal defects, persistent arterial ducts in adults, ruptured sinus of Valsalva aneurysm, Para-prosthetic valvular leak, coronary-cameral fistula, arterio-venous fistula, pulmonary arterio-venous fistula etc.
- ◆ Percutaneous implantation of IVC filter.



- ◆ Intra-aortic balloon pump counter-pulsation, which is used to support hemodynamically unstable patients.

Academic activities

1. The division offers the following programs where the candidates are given exposure to various aspects of the practice of Interventional Cardiology. Post Doctoral Fellowship in Adult Cardiology and Interventions: (2 positions in a year) One year program after completion of DM Cardiology. The program involves hands-on training in all diagnostic aspects of adult cardiac care as well as interventional cardiac catheterizations. The Fellowship provides ample opportunities for professional and academic enhancement including research projects and publication/ presentation of scientific papers.
2. Residency In Cardiology - DM cardiology trainees are trained on the various aspects of cardiac care including clinical cardiology, various non-invasive diagnostic methods and protocols, workup and management of patients with various ailments, workup of patients for invasive procedures, interpretation and analysis of various hemodynamic data, performance of invasive cardiac procedures including hands-on training wherever applicable.
3. Technicians program - DCLT: The students enrolling for the technician courses in Cardiology are imparted training on the performance and maintenance of various modalities.
4. Nursing students - Post-basic nursing program in cardiology.
5. The division conducts dedicated sessions on interventional cardiology and device to DM cardiology residents and fellows every Wednesday.
6. Intervention division also actively participates in the weekly MRI meeting along with the ISIR department.

Research Programmes

CARE – HF ICMR Program

The ICMR Centre for Advanced Research and Excellence (CARE) in Heart Failure (HF) with a funding of 5 Crores is one of the flagship research initiatives of the institute.

Seven research projects are under the umbrella of this program. The National HF database is having a database of nearly 25000 patients with HF from different parts of the country.

National HF Biobank Facility, the first in the country provides state-of-the-art storage facilities for bio samples of patients with heart failure and was inaugurated in August 2021. The genetic study in patients and family members of hypertrophic cardiomyopathy is continuing with the identification of novel mutations which are going to be validated by Sanger sequencing. Other nationwide multicentric research activities including the assessment of the economic impact of heart failure, the development of a new tool for assessment of quality of life (QOL) in Indian patients, and a 2x2 factorial trial on HF management is ongoing as part of CARE-HF.

Another key activity of CARE was the development of a point-of-care device for estimating biomarkers (NT Pro-BNP) in patients with heart failure in collaboration with the Biomedical Technology Wing of our institute and the Rajiv Gandhi Centre for Biotechnology.

New Initiatives

1. Digoxin in patients with rheumatic heart disease - A randomized placebo-controlled trial. (No.50/4(1)/TF-CVD/SG/2021-NCD-I). ICMR funded. PI: Dr Arun Gopalakrishnan, Co-PI: Dr Sanjay G, Dr Harikrishnan S, Dr Krishna Kumar M April 2022.
2. RISE-HF Trial- New multicentric ICMR Funded trial started after IEC clearance. Site PI: Prof Harikrishnan S, Co-PI- Dr Jyothi Vijay MS, Prof Sanjay G



Major Events

- ◆ Heart Failure Clinics Plus Edition 2022 Episode 1 on 22nd April 2022, an online nationwide teaching program for Cardiology residents, on behalf of the Heart Failure Association of India (HFAI). Attendance: 369.
- ◆ Nursing update in heart failure – Organized by the department of cardiology and nursing division of SCTIMST supported by the Heart Failure Association of India on 23rd July 2022.
- ◆ Back To Basics Simulator-based cardiology training program at SCTIMST with nearly 200 residents in training from across the country and neighboring countries.
- ◆ **Heart Failure Conflux** The 3rd confluence of Basic Scientists and Clinicians caring for heart failure was held on the online platform on Feb 4th and 5th. 2023 and 250 basic scientists and clinicians across the country and abroad participated in the meeting. The keynote lecture was delivered by Dr. Giuseppe Rosano, President Heart Failure Association of the European Society of Cardiology. The meeting was organized by the Center of Excellence for Heart Failure of ICMR at SCTIMST, Supported by the Heart Failure Association of India and ICMR
- ◆ **Cardiovascular Biobanking** – A one-day virtual meeting was organized by the Heart Failure Biobank of the Center of Excellence for Heart Failure of ICMR at SCTIMST in February 2023, supported by the Heart Failure Association of India and ICMR. Many national and international experts in biobanking participated in the meeting.

Awards and Honours

1. The prestigious Prof. MS Valiathan Award for Outstanding Research investigator - 2022 is awarded to Dr S HARIKRISHNAN, Professor and head, Department of Cardiology.
2. Dr Harikrishnan S was selected as an Editorial Consultant (heart failure) for the Journal – Journal of the American College of Cardiology

– Heart Failure (JACC -HF).

3. Dr Harikrishnan S was appointed as the chairman of the Local Advisory Committee (LRAC) of the Multi-Disciplinary Research Unit in Govt. Medical College, Trivandrum, which is under ICMR.
4. Dr Harikrishnan S was elected as the Chairman of the Council on Heart Failure of the Asian Heart Society on October 30, 2022.
5. Dr Harikrishnan S was appointed as a member of the Committee on “Medical Device Technical Advisory Committee for Cardiology” and attended its inaugural meeting on 6th December at National Health Authority Headquarters, New Delhi
6. Dr Harikrishnan S was nominated as a member of the Steering Committee (SC) Meeting of the Sophisticated Analytical Instrument Facilities (SAIF) program of DST and attended its 2022 meeting at IIT Delhi on 15th December 2022.

Staff

Faculty

Dr Harikrishnan S, Professor and Head

Dr Bijulal S, Professor

Dr Sanjay G, Professor

Dr Abhilash S P, Professor

Dr Sravan Kumar, Assistant Professor (ad-hoc)

DIVISION OF CARDIAC ELECTROPHYSIOLOGY

The Division of Cardiac Electrophysiology (EP) at SCTIMST is one of the premier services of its kind in the country devoted to the care of patients with abnormalities in heart rhythm. In fact, the EP division of the institute has been recognized at the international level in the evaluation and treatment of cardiac arrhythmias for its clinical, academic, and research activities. The division takes care of patients at risk for sudden cardiac death and patients with heart failure patients who may potentially benefit from device-based therapy as well. The division of cardiac



electrophysiology offers a full range of diagnostic and therapeutic services from simple to extremely complicated and life-threatening arrhythmias.

Facilities & Services

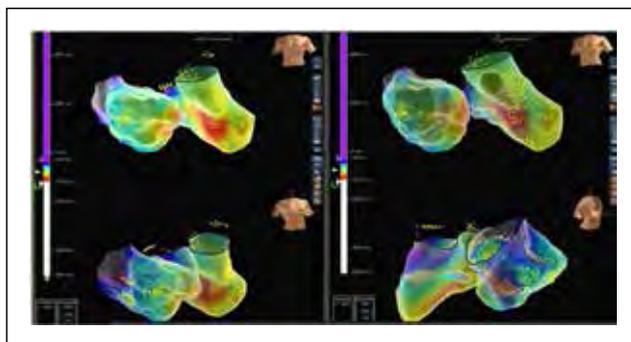


Figure 22: From a recent publication of innovative technique of successful conduction system pacing in CCTGA (Europace.2022 Dec 12: euac239)

- ◆ The electrophysiology program in the department undertakes over 800 cases of pacemaker implants and electrophysiological studies supplemented by radiofrequency ablation each year. Catheter-guided electrophysiology testing and radiofrequency ablation are provided to patients with various cardiac rhythm disorders like atrioventricular re-entry (AVRT), atrioventricular nodal re-entry (AVNRT), atrial tachycardia, atrial flutters, atrial fibrillation, and ventricular tachycardias.
- ◆ Our Electrophysiology division is provided with a dedicated Cardiac electrophysiology laboratory with a state-of-the-art 240-channel intracardiac ECG monitoring system (BARD-EP LAB SYSTEM PRO) system) and the 3D Electro anatomic mapping system (EnSite system and CARTO-RMT Version 3). SCTIMST is one of the leading centers in the country for advanced 3D electro-anatomical mapping facilities for arrhythmia management with an annual turnover of over 150 cases being done using this facility.
- ◆ SCTIMST EP division has also one of the largest

experiences in the country in managing pediatric arrhythmias too.

- ◆ With the availability of the Cryoablation facility, our center is the only public sector hospital in the country to have this as an adjuvant to the ablation of complex arrhythmias like atrial fibrillation.
- ◆ The division also performs device management of various pacing modalities, like single and dual chamber implants, which are being done regularly. Significant experience in conduction system pacing is one specialty of our division. The division regularly performs intracardiac cardioverter-defibrillators for recurrent ventricular tachycardias not amenable to radiofrequency ablation and biventricular pacing (cardiac re-synchronization therapy) for congestive heart failure.
- ◆ The pacemaker follow-up clinic is run every Tuesday and the complex devices and arrhythmia clinic (CDAC) on every Thursday to ensure meticulous programming of these devices to ensure optimal clinical utility and battery management.
- ◆ Apart from these, the electrophysiology division maintains a non-invasive cardiac laboratory that has a 24-hour Holter System with advanced features. The division also performs the Head-up-tilt-table test (HUTT), an essential test in the diagnostic evaluation of syncope. The additional diagnostic evaluations in the electrophysiology lab include assessment of sinus nodal and AV nodal functions, assessment of inducibility of ventricular tachycardia, drug challenge (flecainide, adrenaline, etc.) tests for channelopathies, autonomic function tests and implantation of loop recorders.

Clinical Activities

EP division offers comprehensive care to those patients with arrhythmia ranging from fetuses to the elderly. Service of the EP division is available in outpatient (new and review), in-patient, ICU, and invasive EP facilities round the clock in SCTIMST.



- ◆ Comprehensive Device and Arrhythmia clinic dedicated to optimization and follow-up of patients with complex cardiac devices like CRT, AICD conduction system pacing, and combo device.
- ◆ EP clinic and VT clinic are the new arrhythmia clinic for review of patients with complex arrhythmia. They run on Thursdays in specialty clinics.
- ◆ Periodic ECG forums, journal clubs, and problem-oriented discussions are being conducted regularly.
- ◆ EP division also actively participate in weekly MRI meet.

Academic activities

1. Post-Doctoral Fellowship in cardiac electrophysiology: one-year program after completion of DM Cardiology. The program involves hands-on training in all diagnostic aspects of adult and pediatric cardiac arrhythmias well as interventional electrophysiology and pacing. The Fellowship provides ample opportunities for professional and academic enhancement including research projects and publication/presentation of scientific papers. SCTIMST is the first center to initiate a dedicated cardiac electrophysiology fellowship program and 20 candidates have finished this postdoctoral course and are now practicing the subspecialty at various parts of the world. This is the largest number for any dedicated fellowship program in any cardiac subspecialty in the country.
2. Residency In Cardiology - DM cardiology trainees are trained on the various aspects of cardiac arrhythmias including clinical cardiology, various non-invasive diagnostic methods and protocols, workup and management of patients with various ailments, workup of patients for invasive procedures, interpretation and analysis of various tracings performance of invasive cardiac procedures including hands-on training wherever applicable.

3. Technicians program - DCLT: The students enrolling for the technician courses in Cardiology are imparted training on the performance and maintenance of various modalities.

The division conducted dedicated sessions on EP and devices to DM cardiology residents and fellows every Friday.

Research Programmes

- ◆ Cardiac Channelopathies - Genotype and phenotype correlation, recognition, family screening, and optimal management. ICMR funded ongoing study under ICMR task force.
- ◆ Cardiac Conduction system pacing registry (multicentric extramural funding).
- ◆ Effect of yoga in cardiovascular risk factors, heart rate variability, and Framingham score - a community-based study. Funded by DST under the Satyam project.
- ◆ Image integration: Fusion of 3D electroanatomic mapping systems with cardiac MR/CT acquired images.
- ◆ Post-atriotomy atrial tachycardias - delineation of the electrophysiological characteristics of complex re-entrant circuits.
- ◆ Cryoablation registry (extramural funding approved; being initiated).
- ◆ Stereotactic beam radiotherapy for treatment of VT (Funded by IHRS; extramural funding approved; being initiated).
- ◆ AF registry (follow-up evaluation of Kerala AF registry).
- ◆ Rheumatic atrial fibrillation- epidemiology, rhythm vs. rate management, electrophysiological characteristics.

New Initiatives

1. New externally funded research project - "To treat cardiac arrhythmia patients with cryoablation catheters in India - The Cryoglobal



registry". An externally funded registry study received IEC approval and was initiated (PI: Dr Narayanan Namboodiri; Co-PI: Dr Abhilash S P and Dr Jyothi Vijay).

2. Comprehensive Device and Arrhythmia clinic dedicated to optimization and follow-up of patients with complex cardiac devices like CRT, AICD conduction system pacing, and combo device.
3. EP clinic and VT clinic are the new arrhythmia clinic for review of patients with complex arrhythmia. They run on Thursdays in specialty clinics.

New Diagnostic and Therapeutic Innovations

1. Physiological pacing program: This is a treatment modality introduced worldwide less than half a decade ago and performed over 120 cases so far. A multicentre project on physiological pacing involving a few centers in Kerala is underway.
2. Cryoablation program: This is a novel therapy for the treatment of atrial fibrillation. With short training in Gottsegen National Cardiovascular Center, Budapest (Hungary), and with the help of a few workshops by 4 international visiting faculty last year, we have established cryotherapy for atrial fibrillation as a new treatment option for patients with AF. This therapy has helped 20 patients with refractory arrhythmia in one year. SCTIMST, Trivandrum is the only single in the public sector in the country to have a cryoablation program now.
3. Innovative work in common arrhythmias and international recognition: Expertscape, an international agency from the United States that objectively ranks people and institutions by their expertise in more than 29,000 biomedical topics had placed SCTIMST, Trivandrum as the eighth best institute in the world based on the contributions in the last 10 years to the clinical, academic and research work in areas related to two common cardiac rhythm disorders (atrioventricular nodal re-entry and atrioventricular re-entry). SCTIMST,

Trivandrum was also ranked eighth in both areas based on our contribution.

4. Physiological pacing in complex congenital heart diseases where the conduction system has abnormal anatomy is a therapeutic challenge. I have done, for the first time in the world, physiological pacing in 3 patients with congenitally corrected transposition of great arteries. This has been published as a novel technology in Europace this year (Namboodiri N, Kakarla S, Mohanan Nair K K, et al., Three-dimensional electroanatomical mapping guided right bundle branch pacing in congenitally corrected transposition of great arteries. *Europace*. 2023;25(3):1110-1115).

Events Organized

1. Regular workshops on advanced techniques with internationally renowned electrophysiologists: This endeavor had been helpful in knowledge exchange and imbibing the new developments in the field of cardiac electrophysiology by the institute and the country. For example, last year, we conducted 4 workshops with international faculty – Dr Sorentino (Medical director, electrophysiology, IOWA heart center), Dr Devi Nair (Director of Cardiac Electrophysiology, St. Bernard's Heart and Vascular Center), Dr Maninder Singh Bedi (Director, Electrophysiology services, Regional cardiac arrhythmia Inc., Steubenville, Ohio) and Dr Csaba Foeldes, Director, cardiac electrophysiology services, Gottsegen national cardiovascular center, Budapest).
2. Regular training sessions for visiting cardiologists: We had been conducting workshops on complex arrhythmia ablation, and physiological pacing on a regular basis for cardiologists from different parts of the country. This is an observership program, attended by 3-4 cardiologists at a time. These workshops help to train them on advanced techniques in the mapping and ablation of complex arrhythmias to the cardiology community in the country.



3. Had two DM cardiology residents from Salem medical college for one month each as observers in the EP division.
4. **Cryoablation for atrial fibrillation** workshop was conducted on April 7th and 8th 2022 in the EP division of the cardiology department. Cryoablation is a newer facility for AF ablation available in very few hospitals across India. SCTIMST is the first public sector hospital to do this procedure in the country.
5. **Arrhythmia week celebrations** were conducted by the division of cardiac electrophysiology on the 2nd week of June 2022. Various live demonstrations and training programs on CPR, AED use was held to educate the public and patients about sudden cardiac death and heart rhythm disorders.
6. **Symposium on conduction system pacing** - A symposium on cardiac conduction system pacing was held in the electrophysiology lab and seminar hall on June 27 and 28. Various didactic lectures and demonstrations of techniques of conduction system pacing were conducted by the Department of Cardiology. Faculty and fellows of the EP division and residents presented lectures and challenging case scenarios.
7. **CRT Workshop** - A didactic training workshop on cardiac resynchronization therapy (CRT) was held in the cardiac electrophysiology laboratory on 14th February 2023. Three observers from various parts of country participated in this focused training.

Awards and Honours

Prof. Narayanan Namboodiri has been selected as:

1. A working group member for the formulation of guidelines by the Heart Rhythm Society, International Society of cardiac electrophysiologists in the guideline committee: on arrhythmic risk in neuromuscular disorders.
2. A working group member for the formulation of guidelines by the European Heart Rhythm Association, the international Society of cardiac

electrophysiologists titled: EHRA Consensus on the management of patients with clustered ventricular arrhythmias/ electrical storm (Completed; to be published soon).

3. An honorary member of the writing committee of the Asia Pacific Heart Rhythm Society.
4. An editorial board member of PACE, an international journal in cardiac electrophysiology.
5. Served as the abstract selection committee member in EHRA.
6. A nominated member of the 'Clinical Advisory Committee' of the Gangwal Medical School project by IIT, Kanpur since 2022. The mandate of this committee is to advise on futuristic clinical programs including patient care and on effective ways to integrate engineering into medical research practice in the proposed medical school by IIT, Kanpur.
7. A nominated honorary member of the assessment and review board of the diplomate national board for the FNB cardiac electrophysiology course since 2022.
8. Expertscape, an international agency from the United States that objectively ranks people and institutions by their expertise in more than 29,000 biomedical topics had placed Dr Namboodiri as the eighth best expert in the world based on the contributions in the last 10 years to the clinical, academic and research work in areas related to two common cardiac rhythm disorders (atrioventricular nodal re-entry and atrioventricular re-entry). SCTIMST, Trivandrum was also ranked eighth in both areas based on our contribution.

Staff

Faculty

1. Dr Narayanan Namboodiri, Professor
2. Dr Abhilash S.P., Professor
3. Dr Jyothi Vijay M S, Assistant Professor (ad-hoc)



DIVISION OF PAEDIATRIC CARDIOLOGY

The Paediatric cardiology wing of the Department of Cardiology, SCTIMST is the most sought-after hub of care for congenital heart diseases in the state. We offer a one-year postdoctoral fellowship program in Paediatric Cardiology. The division offers fetal echocardiography and follow-up of high-risk fetuses with structural heart diseases and cardiac dysrhythmias. The division does an average of 500 Paediatric cardiac catheterizations and interventions annually, which is one of the largest in the government sector in India. The division works in close harmony with the Congenital Heart Surgery division of Cardiac Surgery for hybrid interventions, comprehensive postoperative care and long-term rehabilitation of children with complex congenital heart diseases.

Activities

Clinical Activities

The division of paediatric cardiology attends to children with heart diseases on all days of the week. We also run weekly grown-up congenital heart disease clinic, newborn-infant clinic, pediatric cardiology clinic and pediatric heart failure clinic. The division performs on average 500 cardiac catheterizations and interventions annually. Complex interventions like right ventricular outflow tract stenting, patent arterial duct stenting, stenting of coarctation of the aorta, and closure of portosystemic shunts are also done. The Paediatric Cardiology team of SCTIMST proctored and conducted a series of eight workshops in Paediatric Cardiac Catheterization and Structural Cardiac Interventions at the Cardiac Catheterization Laboratory, SAT Hospital, Government Medical College Thiruvananthapuram from December 2020 – February 2021.

The pediatric cardiology division performs complex transthoracic, transesophageal, and fetal echocardiographic imaging for structural heart disease. Approximately 200 echocardiograms are performed in the pediatric cardiology division weekly. The division conducts daily ward and CCU rounds with bedside training for the residents. The division conducts weekly pediatric forums for training residents. We

also conduct twice weekly joint surgical conferences with the pediatric cardiac surgeon and the cardiac radiologist as part of providing a heart team approach to managing congenital heart disease.

Numerous didactic lectures were delivered inside and outside the institution. We also participated in Departmental, and institutional, programs sponsored by National Associations and other educational Institutions. Mentorship & guidance were provided to students for thesis work.

Research

1. Trivandrum Congenital Heart Disease Registry for Newborns: Technical approval by ICMR (PI: Dr Deepa S Kumar).
2. Effect and outcome determinants of right ventricular function in post-operative tetralogy of Fallot: A retrospective descriptive cohort study: Technical approval by ICMR (PI: Dr Deepa S Kumar).
3. Association and impact of 22q11.2 deletion in conotruncal defects: a prospective observational study funded by PCSI, Dr Deepa S Kumar as chief guide.
4. Kerala Registry of Infective Endocarditis (KIND registry) funded by CSI Kerala Chapter (PI: Dr Arun Gopalakrishnan from SCTIMST).
5. Digoxin in patients with rheumatic heart disease - A randomized placebo-controlled trial funded by ICMR (PI: Dr Arun Gopalakrishnan).
6. Pulmonary Embolism – Registry of Kerala (PERK). A multicentric study funded by CSI Kerala Chapter (PI from SCTIMST: Dr. Arun Gopalakrishnan).

New Initiatives

1. The Division of Paediatric Cardiology did the first Piccolo device deployment in a 3kg baby, a patent arterial duct (PDA) occluder designed for use in newborns and young infants.



- The Division of Pediatric Cardiology, initiated a destination program – “Fontan Clinic”. The Fontan Clinic of Sree Chitra Tirunal Institute for Medical Sciences and Technology was inaugurated on Monday, 26th September 2022 at 08:00 a.m. by Hon. Director of SCTIMST, Dr Sanjay Behari at the Cardiology Specialty Clinics Block. This is the first dedicated clinic in the country dedicated to the care of patients with complex congenital heart diseases who are managed with multiple staged surgeries along the univentricular pathway, the final surgery of which is referred to as the Fontan repair.



Inauguration of the “Fontan Clinic”

- The Division of Paediatric Cardiology launched a webinar series in series in Paediatric Cardiology titled “Problem-solving in Paediatric Cardiology” at the behest of Paediatric Cardiology and Pulmonary Hypertension Society (PPHS).
- Paediatric cardiology observership program - In 2022-23 we had 6 DM cardiology residents (4 from govt medical college Trivandrum and 2 from Salem medical college) as observers in division of paediatric cardiology.

Events Organized

- The Department of Cardiology organized an online CME: Complex ASD Device Closure – Learning with the Masters on 23rd April 2022. The event was inaugurated by Dr. Sanjay Behari, Hon. Director, SCTIMST, and had

eminent faculty in Pediatric and structural heart disease interventions from all over India, and a faculty from Michigan, United States. (Attendance: 167; Organizing Chairperson: Dr K M Krishnamoorthy; Organizing Secretary: Dr Arun Gopalakrishnan).

- The Division of Pediatric Cardiology launched a webinar series on Pediatric Cardiology titled “Problem solving in Pediatric Cardiology” under the behest of Pediatric Cardiology and Pulmonary Hypertension Society (PPHS). The first in the series was inaugurated by Dr. Sanjay Behari, Director of SCTIMST on 15th October 2022. The theme of the event was “Troubleshooting in Fontan circulation”. The event was attended by five international faculty in Pediatric Cardiology besides other national faculty. Dr K M Krishnamoorthy was the Organizing Chairperson, Dr Deepa S Kumar the Organizing Secretary, and Dr Arun Gopalakrishnan the Joint Organizing Secretary of the webinar.
- The Division of Pediatric Cardiology conducted a webinar on “Closure of patent arterial duct; simple to complex” in a series in Pediatric Cardiology titled “Problem-solving in Pediatric Cardiology” under the behest of Pediatric Cardiology and Pulmonary Hypertension Society (PPHS).

Awards and Honours

Dr. Krishnamoorthy K M was awarded “Innovator award” for percutaneous closure of ASD without fluoroscopy at CSI-NIC, Ahmedabad, Jun 18, 2022.

Staff details

Faculty

Dr Krishnamoorthy K M, Professor and Head

Dr Deepa S Kumar, Additional Professor

Dr Arun Gopalakrishnan, Additional Professor

Dr Saurav Banerjee, Assistant Professor (ad hoc)



DEPARTMENT OF CARDIOVASCULAR AND THORACIC SURGERY

Paediatric Cardiac Surgery, Adult Cardiac Surgery, and Vascular and Thoracic Surgery, with 6 operating rooms and 2 ICUs. The department performs around 2000 cardiovascular surgeries a year and sees around 6000 preoperative and postoperative cases in the outpatient department. The department runs Mch CVTS (4 seats) and Mch Vascular Surgery (1 seat) residency programs in addition to the PG diploma in Clinical Perfusion program.

Activities

Clinical Activities

The department is the largest unit in the state with over 2000 cardiac operations being performed annually, clientele ranging from neonates to octogenarians. The department has 3 functional divisions namely Paediatric Cardiac Surgery, Adult Cardiac Surgery, and Vascular and Thoracic Surgery. Services offered are complex congenital heart surgeries in neonates and children, coronary surgeries, valve repairs and replacements including minimal access cardiac surgeries, reoperations, aortic surgeries, both elective and emergencies and vascular surgeries.

Research Activities

1. Titanium Chitra Heart Valve Study (TC2) with Dr Vivek V Pillai as PI and Dr. Bineesh K.R. as the Co-investigator. The pilot human trial of the second generation of TTK Chitra Valve was completed successfully in 40 patients. TC2 is a Rs. 2.9 crore project, funded by National Biopharma Mission, BIRAC, and TTK Health Care Ltd.
2. Bioprosthetic Pericardial Heart Valve – Durable and thrombosis-resistant prosthetic heart valve with good hemodynamic parameters is the ideal replacement alternative for heart valve disease. Bioprosthetic pericardial tissue valves are

currently the ideal solution for these situations. With Dr. Vivek Pillai as Clinical PI, animal trials are ongoing successfully with both the proposed models. Preliminary data demonstrated promising results in terms of design and materials.



Figure 23: Second generation of TTK Chitra Valve

New Initiatives

Two new clinics were started.

1. Fontan Clinic was started along with Dept of Cardiology, to follow up children who underwent univentricular repair.
2. Heart in pregnancy clinic was initiated in collaboration with Dept. of Cardiology and Dept of Obstetrics and Gynaecology, SAT Hospital, Trivandrum to take care of pregnant women with heart diseases

Awards and Honours

1. Dr Vivek V Pillai, Professor, served as a member of the executive committee of Indian Association of Cardiovascular and Thoracic Surgeons, assessor of NMC and member in specialty board (CVTS) of National Board of Examinations.
2. In the VSI Midterm meet in July 2022, awards for the best institute and best resident were bagged by Dr Sriram and Dr Neelam Jingbha Sun.





Figure 24: Bioprosthetic pericardial heart valve

3. Dr. Sowmya Remanan, Additional Professor CVTS, became a Fellow of European Board of Cardiothoracic Surgeons (Congenital Cardiac Surgery), from June 2022.
4. Dr Sowmya Remanan underwent training in the use of ventricular assist devices and heart-lung transplantation at Medizinische Hochschule Hannover, Germany, funded by the Tata Professional Enhancement grant.
5. Dr Vivek V Pillai, Dr Bineesh KR, and Dr Renjith S conducted in-vivo animal trials for Bioprosthetic Heart Valve and Mitral Annuloplasty ring at BMT.

Events Organized

Surgical Conclave of Heart Failure Association of India was organized as a virtual meeting jointly by the departments of Cardiology and CVTS.

Staff

Faculty

Dr Baiju S Dharan, Professor and Head of the Department

Dr Vivek V Pillai, Professor & Division in-charge, Adult Cardiac Surgery

Dr Varghese T Panicker, Professor

Dr Sabarinath Menon, Additional Professor

Dr Bineesh K R, Associate Professor

Dr Sudip Dutta Barua, Associate Professor

Dr Sowmya Ramanan, Associate Professor

Dr Shivanesan P, Assistant Professor

Technical

Ms Beegum Thaslim, Senior Scientific Assistant (Perfusion)

Ms Maya I, Senior Perfusionist

Mr Sujith V M, Perfusionist - B

Mr Don Sebastian, Perfusionist - B

Mr Shanu P S, Perfusionist - B

Mr Rijesh S R, Perfusionist - A

Mr Sujesh S, Perfusionist - A

Ms Beena B Pillai, Transplant Co-ordinator - A

DIVISION OF CLINICAL ENGINEERING

The Division of Clinical Engineering (DCE) is vital to the efficiency, productivity, and safety of the hospital. The scope of the division is not just limited to executing the medical equipment contracts, but also maintaining them in an institutional setting. The mandate of the division is to assist daily operations of the hospital and implement and manage technology-related projects in different stages.

Activities

The equipment management followed a standard-based approach to ensure safe, efficient, and quality maintenance of medical equipment. DCE participated in the selection of suitable equipment to support the services of the institute and conducted training programs and classes on medical equipment for all staff of the institute that assured safe, effective care and treatment of patients. DCE regularly engaged in the need assessment of medical equipment technical support requirements and developed strategies for appropriate calibration, inspection, maintenance, and repair services.

Clinical Engineers in the role of medical technology experts worked towards bringing as much in-house technical support as possible and performed many activities in various stages of the equipment life-cycle such as pre-purchase evaluations, equipment recommendations, purchasing assistance service, incoming inspections, service equipment, contract management, user training, regular preventive maintenance, performance testing, calibrations, breakdown work, equipment installations, replacement recommendations, biomedical networking, user error tracking and maintenance of equipment history.

Activities of the Electrical and Mechanical Sections during the year 2022-23 included routine operation and maintenance of HT panel, transformer, DG sets, and hospital electrical system; overhauling shutdown maintenance for ACB, and VCB in a substation,

operation and maintenance of AC plants, AHUs, medical gas systems, CSSD, laundry equipment, dietary, etc.

A 200 kVA modular UPS was installed in August 2022 which can provide an uninterrupted power supply to the institute.



Figure 25: 200 kVA modular UPS

A new IPBX exchange was installed on 1st August 2022 with 1000-line capacity and extendable up to 1500 to provide an uninterrupted Telephone Communication System in the institute. An external communication has also been made in collaboration with BSNL.

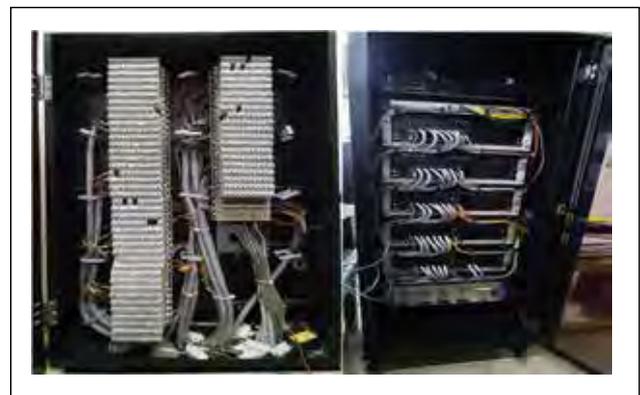


Figure 26: IPBX exchange (1000-line capacity) installed to provide an uninterrupted Telephone Communication.



During 2022-23, the division extended its service to the institute by successfully completing more than 12,000 registered work requests on the computerized complaint-management system. This included testing and certification of the newly installed pieces of equipment, maintenance, and repair of the existing pieces of equipment, and creation of infrastructure and modification of electrical and air-conditioning systems. The division also monitored and documented the activities of outsourced agency service engineers who were deputed for warranty and service contracts.

The work requests managed are summarized in the Table below:

Subdivision	Complaints attended
A/c	682
Communication	568
Electrical	1837
Biomedical/electronics	7930
Fitting/ medical gas line	1891
Total	12,908

Major medical equipment installed during the year

Description	Department	Quantity
Led double dome operation theatre light	Peadiatric ot	1
Medical grade digital video recorder	Peadiatric ot	1
Tyrone camarero workstation	Neurosurgery department	1
Cardiac ablation system with cryo energy	Cardiology dept	1
Temporary dualchamber pacemaker-5392	Comprehensive heart failure (hficu)	1
Pic ix (c) central monitoring system	Cardiology icu	1

Philips tc 20 cardiograph ecg recorder	Ecg room, nsicu, nmicu	4
Ocean slim-50 4 ch led modular monitor	Cardiology	2

Important events/meetings held during the Year 2022-23:

“Know Your Medical Device” (Hospital Equipment Awareness Training Series) for imparting advanced technical training for staff handling the medical equipment. During 2022-23, DCE organized 6 Workshops at SCTIMST by collaborating with different vendors/companies. The following table provides the details of the workshops.



Figure 27: Training Programs



Title and theme of the event	Date	Co-organizers
Know Your Medical Device Episode 1: Electrosurgical unit	02-04-2022	Erbe Medical India Pvt. Ltd.
Know Your Medical Device Episode 3: Patient Monitoring Solutions	07-05-2022	GE and BEC Pvt Ltd
Know Your Medical Device Episode 2: Medical Gas Systems, Modular OT & Critical Care Equipment	03-06-2022 & 04-06-2022	Draeger India Pvt. Ltd.
Know Your Medical Device Episode 4: Ventilators & Anesthesia Workstations	18-06-2022	Allied Medical Ltd.
Know Your Medical Device Episode 5: Anesthesia & Critical care, Energy-based Surgical Devices	02-07-2022 & 16-07-2022	India Medtronic Pvt. Ltd.
Know Your Medical Device Episode 6: Critical Care and OT Solutions	17-09-2022	Getinge Medical India Pvt. Ltd.

- ◆ Training program on the operation and maintenance of Modular UPS was conducted for the Staff of the Electrical section in association with MIS Eaton Power Quality Pvt. Ltd.
- ◆ Energy Conservation Day was observed on 14th December 2022 at SCTIMST. A talk on

“Renewable Energy for a Sustainable and Carbon Neutral World” was given by Dr Ajith Gopi, Joint Chief Technical Manager, ANERT.

- ◆ Talk on “Energy Conservation in Hospital” was made by Er Suresh Babu B V, Accredited Energy Auditor, Bureau of Energy Efficiency, OTTOTRACTIONS.
- ◆ A Competition was conducted for proposing Innovative ideas for Energy Conservation in SCTIMST and prizes were distributed to winners.
- ◆ Biomedical Engineering students from PSG college of Technology, Coimbatore attended a two-week internship (from 13-06-22 to 30-06-22) at the Division of Clinical Engineering.
- ◆ Company Personnel from Getinge Pvt Ltd. visited and gave formal training for the members of DCE on the optimal usage, maintenance, and troubleshooting of Maquet Servo-I ventilators. As part of the visit, MTech Clinical Engineering students (21-23 Batch) were given an opportunity to interact with Engineers from Getinge Pvt Ltd, in a hands-on session.
- ◆ Draeger India Pvt. Ltd. conducted training on Electrical Impedance Tomography, which is a state of art, emerging technology for visualizing human tissue non-invasively. Engineers, trainees, and Clinical Engineering students got an opportunity to interact with the R&D team of Draeger India Pvt. Ltd.
- ◆ Many meetings were conducted with members of various Departments at SCTIMST, to educate and encourage procurement through GeM.
- ◆ Dr Benny P Cherian, Infection Control Doctor/ Consultant Microbiologist, Barts Health NHS Trust, London, United Kingdom, visited SCTIMST and met with all faculties of DCE. An infection control lecture was presented by Dr Benny P Cherian and he gave valuable inputs to our ongoing infection control (TDF, SCTIMST funded) project. It was decided to go ahead with



the plan to establish an MoU between SCTIMST and Barts Health NHS trust soon.

Staff

Faculty

Mr Shaj Upendran, Engineer G & Acting Head

Mr Manoj G S, Engineer D

Mr Anoop Jose, Engineer C

Mr Praveen James, Engineer B

Mr. Vishal V P, Engineer B

Other Initiatives

1. DCE was actively involved in the planning, designing, and construction of the new Hospital Block infrastructure facilities. This included planning and evaluation of services (electrical power, air conditioning, water supply, drainage, medical gases, vacuum chute system, etc.) prepared by CPWD for the new hospital and monitoring the progress of the work with the help of the construction wing and consultants.



Figure 28: Energy Conservation Day celebration

DIVISION OF CELLULAR AND MOLECULAR CARDIOLOGY

The Division focuses on basic and translational research in cardiovascular biology and provides academic training to students. The current research focus is on molecular regulators of myocardial tissue response to injury that could be therapeutically targeted to prevent or minimise cardiac dysfunction. During the year, the Division provided guidance to three PhD students, two ICMR project staff, and one Principal Investigator under the DST Women Scientists' Scheme. Short-term training was given to three MSc students and two BSc students. Ongoing work on cardiac fibroblasts and cardiac progenitor cells resulted in four conference presentations and PhD student received three Awards at the national and institute level.

Activities

Research Programs

1. Regulation of progenitor cell function in the heart

In ICMR funded project, we investigated how the microenvironment post-myocardial injury affected the phenotype and functions of cardiac progenitor cells. In this study, *c-kit* expressing cells were efficiently isolated from the myocardium of young-adult mice by a modified protocol that employed selective plating of cells, cell enrichment by antibody-based magnetic sorting and expansion in culture by supplementing nutrient cocktail (Figure 29). The molecular mechanisms and signalling pathways involved in the phenotypic transition of these progenitor cells, in the presence of Angiotensin II a peptide hormone upregulated in the heart after a myocardial injury was identified. We also correlated the expression of *c-kit* and profibrotic marker protein expression in the atrial appendages of patients with cardiovascular disorders.

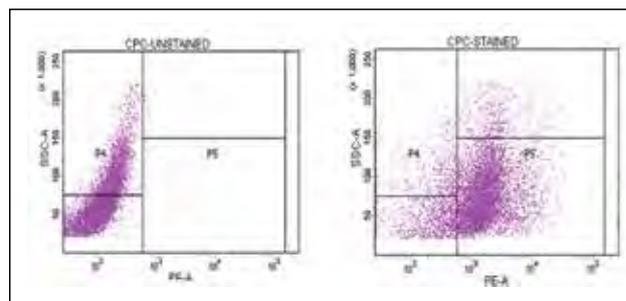


Figure 29: Flow cytometry analysis of *c-kit* positive cells isolated from the mouse myocardium. Unstained cells (left) and PE-stained *c-kit* cells (right).

The findings were communicated as oral and poster presentations in national conferences as listed below.

- a) Indraja Devidasan, Sarayu Gopal, Sruthi Radhakrishnan and Neethu Mohan. "Survival and fate of *c-kit*+ cardiac cells in the injured myocardium: Role of Angiotensin II" at Heart Failure Conflux: Cardiac Metabolism & Metabolic Therapy in Heart Failure organized by Centre for Advanced Research and Excellence in Heart Failure (CARE-HF) SCTIMST, ICMR & IACS on 4th and 5th, February 2023.
 - b) Indraja Devidasan, Sarayu Gopal, Sruthi Radhakrishnan and Neethu Mohan. "Role of Angiotensin II in determining the fate of *c-kit*+ cardiac cells in the injured myocardium" at Advances in Cardiovascular Medicine and Research (ACMR) 2023, jointly organized by IACS & ISHR held at PGIMER Chandigarh from 16-18th February 2023.
- #### 2. Role of connexins in the phenotypic transformation of cardiac fibroblasts and extracellular matrix synthesis in cardiac diseases

In ICMR funded project, we investigated in vitro, how gap junction protein Connexin 43 is regulated in cardiac fibroblasts that are involved in the repair process post myocardial injury. Further, we correlated the expression and



reorganization of Connexin 43 in vivo in the ventricular myocardium of rats, with changes in ECG at different time points of the cardiac repair process and initiation of fibrosis (Figure 30). The study aims to identify a protein that could be targeted to reduce abnormal connexin 43 expression and reduce conduction abnormalities observed during cardiac fibrosis.

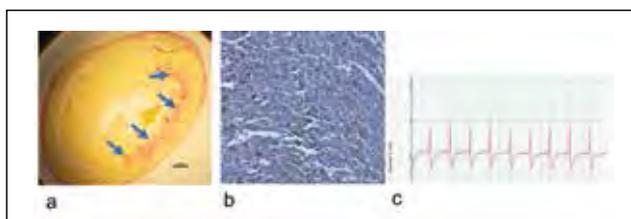


Figure 30: a. Initiation of cardiac repair by fibroblasts after a myocardial injury, arrow points to collagen deposition at the injured site, b) reorganization of Connexin 43 in rat myocardium post myocardial injury and c) changes in ECG pattern one week post myocardial injury in rats.

Further, we also investigated how connexin 43 in turn regulates the expression of profibrotic proteins in cardiac fibroblasts.

3. Transcriptional and translational regulation of periostin and its interaction with DDR2 in cardiac fibrosis

In this study, we investigated how periostin a matricellular protein expressed by activated cardiac fibroblasts regulates the enzyme lysyl oxidase (LOX) involved in the collagen crosslinking in the heart. We were able to identify the molecular mechanisms, signalling pathway and transcription factor in the regulation of LOX downstream of Periostin. Further, the expression of Periostin, excessive collagen deposition, expression LOX and reduction in cardiac wall contraction by ECHO analysis were correlated in a rat model of myocardial infarction (Figure 31). Identification of signalling pathways and molecular targets to prevent excessive collagen crosslinking & cardiac wall stiffening is of high clinical significance.

The recent findings were communicated as oral presentations at national conferences.

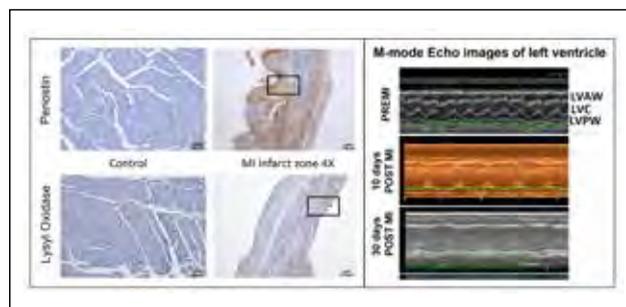


Figure 31: Correlation of periostin & LOX in a rat model of myocardial infarction. b) ECHO images indicating a reduction in cardiac wall contraction post myocardial injury in rats.

- a) Sruthi Radhakrishnan and Neethu Mohan. Periostin mediated regulation of Lysyl Oxidase in cardiac fibroblasts: Implications in cardiac wall stiffening” at Advances in Cardiovascular Medicine and Research (ACMR) 2023, 2023 jointly organized by IACS & ISHR held at PGIMER Chandigarh from 16-18th February.

Awards and Honours

- a) Ms Sruthi Radhakrishnan received C C Kartha Travel Award for the oral presentation titled “Periostin mediated regulation of Lysyl Oxidase in cardiac fibroblasts: Implications in cardiac wall stiffening” at Advances in Cardiovascular Medicine and Research (ACMR) 2023, held at PGIMER Chandigarh from 16-18th February 2023 jointly organized by IACS & ISHR.
- b) Ms Sruthi Radhakrishnan received ICMR SRF Fellowship-2022 for the project “Myofibroblast-Cardiomyocyte crosstalk regulates gap junction remodelling in cardiomyocytes”.
- c) Ms Sruthi Radhakrishnan received First prize for an e-poster presentation held on National Science Day celebrations at Biomedical Technology Wing, SCTIMST (2022), for the poster entitled “Periostin mediated regulation of Lysyl Oxidase in cardiac fibroblasts: Implications in cardiac wall stiffening”.

Faculty

Dr Neethu Mohan, Scientist E & In-Charge

Technical

Ms Sunitha S, Technical Assistant Lab-A



COMPUTER DIVISION

The Computer Division is an integrator for the total Information Technology (IT) infrastructure of the Institute. The division is providing services to the three wings of the Institute (Hospital Wing, Biomedical Technology Wing, and Achutha Menon Centre for Health Science Studies) and serves as a scientific, technological, and data resource for academic, administration, patient care, research, and finance management. The division provides hardware, and in-house developed software for various IT solutions. Data Centre maintained by the division is built on the latest information technology with state-of-the-art infrastructure for housing various servers, storage, and networking equipment.

Activities

1. Maintenance of online application software, updating and development of new modules as per the user requests.
2. Web Site (Intranet, Internet) English and Hindi, Email maintenance, site updates, and new development.
3. Network monitoring, management, maintenance, and new cabling work.
4. Tender publishing, Online recruitment of Staff and Students.
5. Updating and maintenance of all Portals (Blood Donor, Vendor, Pension, CSC, Patient), D Space, e-learning, etc.
6. OMR evaluation, Recruitment (SSSC, JSSC), Academic admissions.
7. Report generation for Auditors, IT Committee, DST, etc.
8. Hardware and software maintenance of servers, storage, PC's, routers, switches, scanners, printers, etc. with a remarkable uptime of 99.98% (Total 2184 devices).
9. Monitoring of Data Centre, Management of 18 Physical Servers and 60 Virtual Servers, Storage (350 TB x 2), and Network.
10. Data backup, maintenance of data, and network security.
11. Monitoring e-payment status.
12. Monitoring of medical equipment integrated into EMR, Surveillance, etc.
13. Work related to online Video Conference Meetings for various departments and selections.
14. Training for Apprentices, Staff, and Students.
15. General help to staff, and students on IT-related issues.
16. Preparation of monthly reports, work orders, indents, tender processing, etc.
17. Conduction of various examinations related to department recruitment.
18. Upgradation of various software platforms – Cloud Storage, Redcap data collection software, Email Server, VC Software, Openproject, Gateway Security, Backup Software, ODK, R Server, etc.

New Initiatives

Developed and launched the following new websites and web portals.



1. Portal for Dural Arteriovenous Fistula Referral and Research. The link is <https://dafd.sctimst.ac.in>.
2. Website for Institute Alumni. Link is <https://alumni.sctimst.ac.in/>
3. Website for Gender Advancement for Transforming Institutions (GATI). Link is <https://www.sctimst.ac.in/GATI>
4. Patients Portal integrated with Chat Assistance. Link is <https://patientportal.sctimst.ac.in/>
5. Institute Journal OMSTH Portal. The link is <https://omsth.sctimst.ac.in/omsth>.
6. Website for “Smriti Vanam Programme”. Link is <https://www.sctimst.ac.in/sv/>
7. Web page for Cyber Jaagrookta awareness
8. Developed GeM Tracker software Website for tracking GeM Orders and their status.
9. Developed software for Anaesthesia pre-operative assessment.
10. Introduced software for Hardware Maintenance Service for Computer Division.

Events Organized

Computer Division organized a webinar on Cyber Security Essentials as a part of Cyber Jaagrookta Diwas celebration on 02.06.2022. Sri Dittin Andrews, Scientist E, M/S CDAC gave a talk on Cyber Security.

Computer Division organized a webinar on “Cyber Security Essentials” as a part of Cyber Jaagrookta Diwas celebration on 06.10.2022. Dr Gaurav Gupta, Additional Director, Scientist E, Meity, New Delhi gave a talk on Cyber Security.

Staff

Mr Suresh Kumar B, Engineer F & Acting HOD

Dr Geetha G, Scientist G (Sr. Grade)

Mr Rejith L R, Sr. Programmer

Mr Saji K S, Programmer - B

Mr Manoj M, Technical Assistant (Computer) - B

Mr Anish R, Technical Assistant (Computer) - B

Mr Sakilnag P S, Technical Assistant (Computer) - B

New modules added for staff/student/patient care services

1. Management system for KASP- Ayushman Bharat scheme integrated with Medical Records software.
2. Software for Children Education Allowance Request.
3. New Video conferencing Server Installed for Patient Video conferencing.
4. Introduced new interfacing of Point of Sale (POS) in the Payment Kiosk.
5. Developed the Patient Health Survey system in four languages.
6. Developed a new module in PACS for Cardiology (Integrated with ECG equipment).
7. Completed implementation of the Public Financial Management System (PFMS).



DEPARTMENT OF IMAGING SCIENCES AND INTERVENTIONAL RADIOLOGY

The Department of IS and IR provides comprehensive diagnostic and interventional radiology-based services for patients attending the Institute. It runs separate DM programs in Neuroimaging and Interventional Neuroradiology, Cardiovascular imaging and vascular interventional radiology, and a 2-year diploma program for Radiology Technologists (Diploma in Advanced Medical Imaging Technology, DAMIT). There are six permanent faculty members, nine technologists, 15 senior residents, six DAMIT students, and two Research fellows associated with the department. The department runs daily teaching sessions and contributes to multi-disciplinary clinical meetings with the Neurology, Neurosurgery, Cardiology, and Cardiac surgery departments. The department runs separate OPDs for interventional Neuroradiology and Vascular Radiology and has a dedicated ICU and ward for patients undergoing interventional procedures. The department equally focuses on research (basic science and clinical), discovery, and development of technologies related to patient care.

Activities

Clinical Activities

The number of diagnostic procedures done in 2022-23 includes 6474 MRIs, 3157 USGs, 4953 CT scans, and 35377 X-ray scans. There were 1262 interventional procedures done during the same period and covers neuro interventions, peripheral interventions, and diagnostic angiograms. There were 891 new OPD cases and 3964 review cases during 2022-23. Furthermore, 884 patients sought in-patient admissions in the department. We have achieved a bed occupancy rate of 98%. The average length of hospital stay was 5 days with in-hospital mortality <1%. Hospital-acquired infection rate was also <1%.

Research Programmes

The department runs major Collaborative research activities in Medical Image processing, AI, and Virtual reality.

- ◆ The development and validation of the new AI-driven image analysis software for myocardial scar quantification from cardiac MRI was completed. The software is now moving towards a product phase. We have also finalized a tripartite MOU between SCTIMST, Dayanand Sagar College of Engineering, Bangalore, and Heart-health private limited.
- ◆ Patent rights were received for a new Radiopaque Polymeric Liquid Embolic System – for the management of brain vascular malformations.

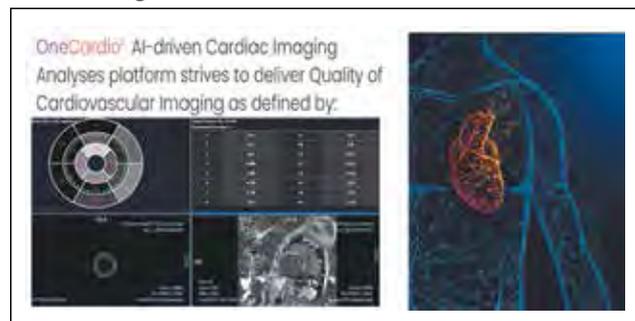


Figure 32: AI-driven image analysis for myocardial scar quantification from cardiac MRI.

- ◆ Design Registration was received for the liquid embolization agent Lid Nidus Construct.
- ◆ In Vitro AVM model for liquid embolic agent evaluation.
- ◆ The patented liquid embolic agent technology was transferred to M/s Biorad Medisys for further development, evaluation, manufacture, and sale. The technology was transferred on 27.6.2022.
- ◆ The department is part of the development of an Artificial Intelligence-based System for Comprehensive Cerebral Arterial Stroke Imaging and Prognostication, funded by DBT.
- ◆ The Department is conducting prospective research projects on resting-state functional



networks and their cognitive correlates before and after embolization therapy in dural arteriovenous fistula supported by CSRI- DST and ICMR.

- ◆ The department is also continuing the development of a virtual reality-based anatomy teaching tool funded by SERB.

- ◆ The department started a dedicated web page for dural arteriovenous fistula research, referral, and management.

- ◆ Echo planar image mix (Epimix) sequences were started in MR imaging of the brain for motion artifacts reduction and greater susceptibility effects.

New Initiatives

- ◆ Peri-coronary fat estimation tool was developed

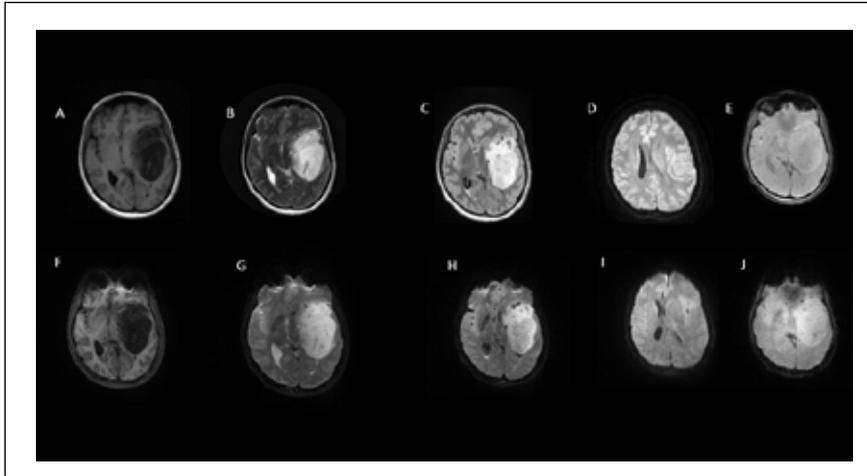


Figure 34: Echo planar image mix (Epimix)



Figure 35: Peri-coronary fat estimation

for prognostication of the coronary artery disease.

- ◆ Arterial interventions via the popliteal artery were started in the department. These help in treating complex below-knee arterial diseases.
- ◆ Varicose vein embolization using endovascular glue was started in the department. The procedure is OPD based and obviates the need for surgery in varicose veins and takes around 30 minutes to complete.
- ◆ Plug-assisted retrograde obliteration of gastric varices for refractory bleeding variceal bleed was started in the department.

Newer techniques in imaging

- ◆ 4D flow MR imaging in congenital cardiac diseases to quantify the pulmonary blood flow was started.
- ◆ Use of radiomics and AI based tools in evaluation

of response in hepatocellular carcinomas was initiated

- ◆ Non contrast QISS MRI sequence was started in dialysis patients to obviate the need of MR contrast agents.

Events Organized

The department organized the International Day of Radiography celebrations and conducted a Radiology safety awareness program for patients and caregivers in the institute on 14 November 2022.

The department organized an online radiology quiz for the radiology residents on 4 March 2023, which was attended by 105 teams across India.

The department organized a workshop in vascular closure devices and radial artery access at the Indian Society of Vascular interventional radiology conference held in Hyderabad February 9-12, 2023.



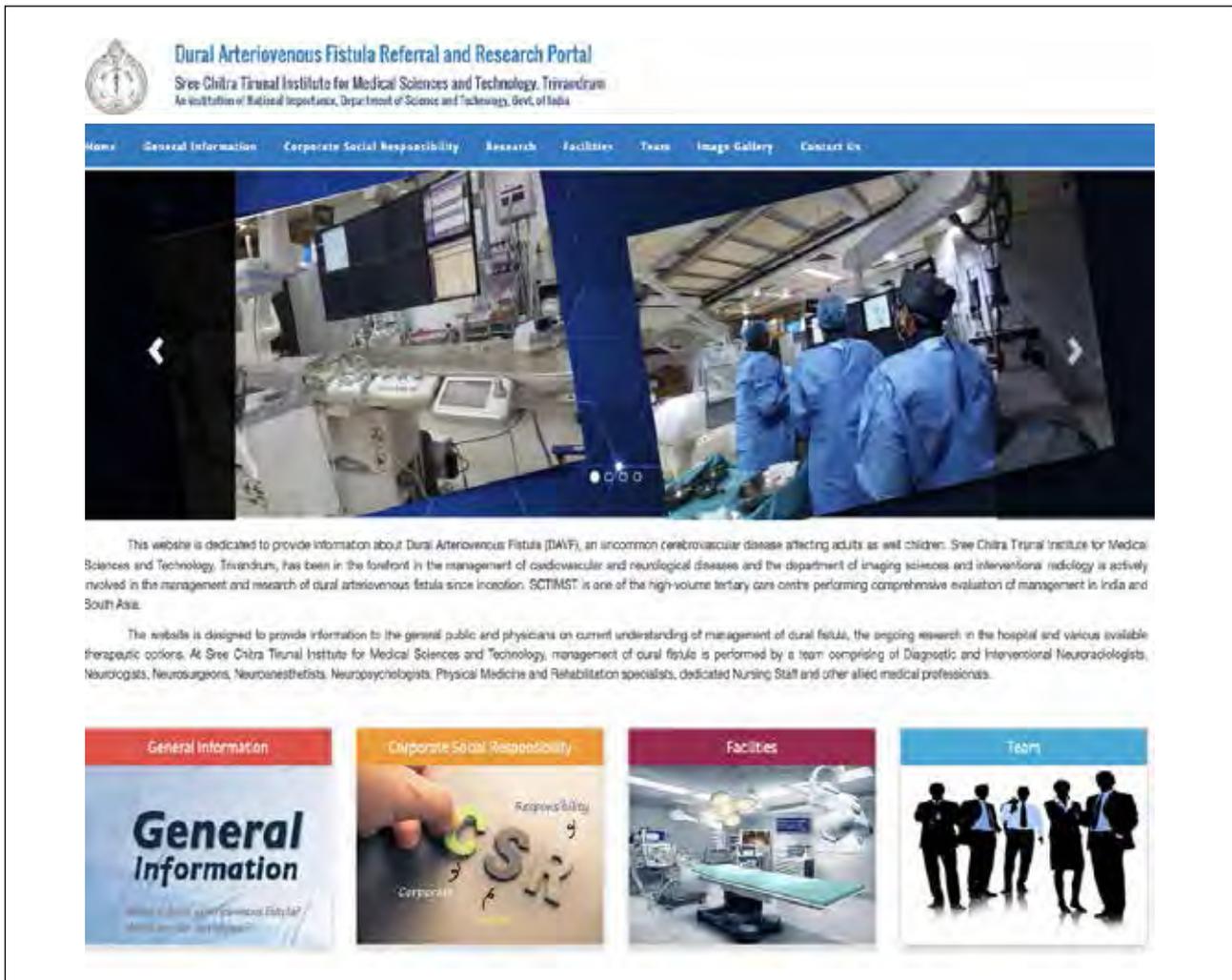


Figure 33: Web page for dural arteriovenous fistula

Awards and Honours

- ◆ Dr Jayadevan ER won the National Petrochemical Award for the invention of Metal-free radiopaque polymeric material for the embolization of brain arteriovenous malformations.
- ◆ Dr Jayadevan won the award for professional excellence in the science day celebration in SCTIMST.
- ◆ Dr Bejoy Thomas was awarded, St. Berchmans' College Outstanding Alumni, on 1st May 2022.
- ◆ Mr Alex Jose D was selected for the Best Radiographer award at the Society of Indian Radiographers (SIR) Kerala chapter CME on February 26th 2023 at IQRAA International Hospital and research centre, Calicut.
- ◆ Dr Jineesh V, Associate Professor, won the “best paper in vascular interventional radiology” and “overall best oral presenter award” for the paper ‘Imaging and clinical factors predicting difficult IVC filter retrieval’ at the Indian Society of Vascular and Interventional Radiology National conference held in Hyderabad, on February 9-12, 2023.
- ◆ Dr Jineesh V, Associate professor, won 3rd prize in the quiz competition conducted by the institute on Women’s Day.





Figure 36: Varicose vein embolization using endovascular glue.



Figure 37: Plug-assisted retrograde obliteration of gastric varices

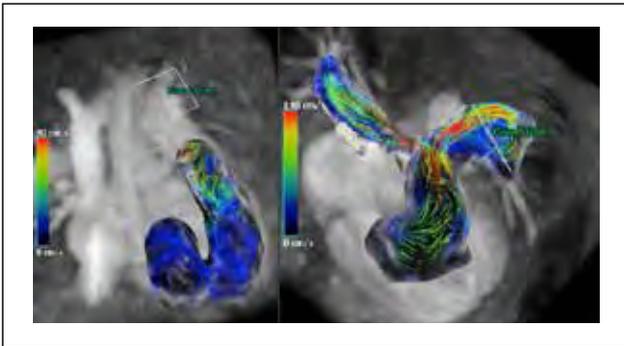


Figure 38: 4D flow MR imaging in congenital cardiac diseases



Figure 39: Non contrast QISS MRI

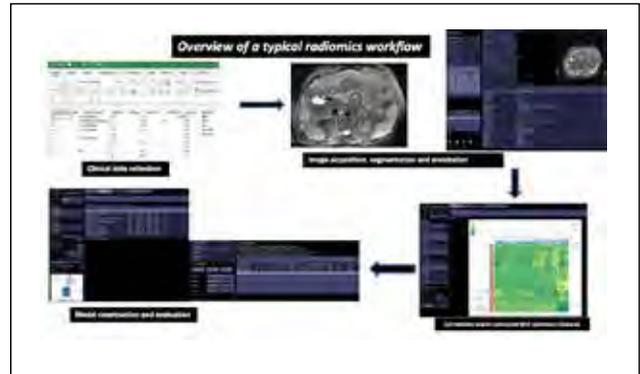


Figure 40: AI based evaluation of response in hepatocellular carcinomas

- ◆ Dr Viswanadh K S V G, Final year Resident in DM Neuroimaging and Interventional Neuroradiology from the Department of Imaging Sciences and Interventional Radiology won second prize in Neurointerventional Radiology Quiz conducted on 11th February 2023 at Hyderabad.
- ◆ Dr Venkata Subbaih A and Dr Jayakrishnan R, second-year residents won third prize in the national level Grand Finale ISVIR Quiz, 2023 held on 11th February, 2023 at Hyderabad.
- ◆ Dr Viswanadh K S V G, final year resident won the first prize in oral presentations for the paper 'Advanced MR imaging Correlates of Histopathological changes in Amygdala and the Temporal Neocortex in Mesial Temporal Sclerosis' at the Indian Society of Neuroradiology conference held at New Delhi between February 24-26, 2023.
- ◆ Dr Deepmala Karmakar Final year resident, won 1st prize in the interventional radiology quiz, 2023 held on February 2023 at KIMS hospital.
- ◆ Miss Gayathri and Mr Ashish Mohan V P, secured First prize in the quiz competition in SIR state level CME 2023, conducted by GE Healthcare at IQRAA International Hospital and research center, Calicut.
- ◆ Dr Bellala Ajay Pavan Kumar, 3rd-year Resident, won 1st prize for oral paper presentation for his original research paper titled "False lumen



Figure 41: Alex Jose D was selected for the Best Radiographer award at the Society of Indian Radiographers (SIR) Kerala chapter.

regurgitation fraction, energy loss in aorta and wall shear stress measured by 4D flow MRI in predicting expansion of acute uncomplicated type B aortic dissection” at the 12th Annual Conference of Indian Association of Cardiac Imaging on 15th and 16th October at Goa.

- ◆ Dr Basavaraj N Biradar, 2nd year Resident, won 2nd prize for oral paper presentation for a research paper titled “Pericoronary fat attenuation index (FAI) and plaque volume as predictors for major adverse cardiac events - a prospective cohort study” at the 12th Annual Conference of Indian Association of Cardiac Imaging.
- ◆ Dr Jayakrishnan R, 1st-year Resident, won 1st prize for scientific exhibit presentation for “Imaging in bidirectional Glenn shunt. What a radiologist should know” at the 12th Annual Conference of Indian Association of Cardiac Imaging on 15th and 16th October at Goa.
- ◆ Dr Venkata Subbaih A, 1st-year Resident, won 2nd prize for scientific exhibit presentation for his exhibit titled “Imaging Spectrum of Cardiovascular Manifestations of Abernathy Malformation” at the 12th Annual Conference of Indian Association of Cardiac Imaging. 15th and 16th October at Goa.
- ◆ Dr Deepmala Karmakar, 2nd-year resident, DM Cardiovascular Imaging and Vascular Interventional Radiology, won 1st prize for Dr Ravi Bathina Cardiac Imaging Quiz at the 12th Annual Conference of Indian Association of Cardiac Imaging on 15th and 16th October at Goa.

- ◆ Dr Deepmala Karmakar, Senior Resident, presented an oral paper “Percutaneous Closure of a Congenital Intrahepatic Portosystemic Shunt Using a Novel Technique” in The Sirius, Interventional Radiology conference, and won the Travel grant of Rs. 60,000/- for an International Conference/ Fellowship for the same.

Staff

Faculty

Dr Bejoy Thomas, Professor & Head

Dr C Kesavadas, Professor and Deputy Director

Dr E R Jayadevan, Professor

Dr Santhosh Kannath, Professor

Dr A Anoop, Associate professor

Dr Jineesh V, Associate professor

Technical

Ms Githakumari V., Junior Scientific officer

Mr Alex Jose D, Senior Technical Assistant

Ms Sheeba Kumari R, Senior Technical Assistant

Mr Johnson C, Senior Technical Assistant

Mr Krishna Kumar N, Senior Technical Assistant

Mr Vikas K N, Senior Technical Assistant

Mr Mahesh P S, Senior Technical Assistant

Ms Joyi K, Senior Technical Assistant

Ms Sandhya V S, Senior Technical Assistant



DEPARTMENT OF MICROBIOLOGY

Department of Microbiology receives specimens from different clinical departments and provides accurate and timely reports. It also provides clinical microbiology consultancy services to other departments. The department leads the antibiotic stewardship program of the institute in liaison with the Hospital Infection Control Unit. The department is actively engaged in outbreak investigation and employs strategies for containment using microbiological methods. Regular training and skill-building sessions in infection control for all classes of staff are conducted by the Microbiology department at regular intervals.

Activities

Clinical Activities

The department attended and provided reports on 9881 and 118 samples on bacteriology, and mycobacteriology, respectively. There were 55 fungal isolates identified in the year 2022-23. In total 5081 samples were processed for various serological parameters and include c-reactive protein, rheumatoid factor, ASO, syphilis treponemal antibody, and RPR. Further, 2997 and 18730 assays on procalcitonin and thyroid function tests were conducted, respectively. Additionally, viral serology diagnosis was performed on more than 9400 samples for HIV, HCV and HBsAg. Molecular diagnosis of SARS CoV2-RT-PCR and rapid PCR were performed among 9100 and 1022 samples, respectively. Multiplex RT-PCR panels on viral meningitis/encephalitis, meningoencephalitis panel with CSF samples, and respiratory panel with nasal/nasopharyngeal/sputum samples were performed. Sequencing studies were conducted in three samples.

The department harvested 16 pulmonary and aortic valves each and stored them in the homograft valve bank. Of these, 11 were implanted. In the majority of the cases, the homograft was used for intracardiac repair with conduit, aortic root replacement, mitral valve repair, and bi-ventricular repair.

Antibiotic Policy - For the first time, a committee

consisting of clinicians and members of ICT was constituted to develop an antibiotic policy for the Hospital Wing of the Institute. A series of meetings were organized with the clinical department representatives, separately for each unit. Regular activities of antimicrobial stewardship and infection prevention were carried out throughout the year. There were no outbreaks during 2022-23. Any increase in healthcare-associated infections was quickly contained by appropriate measures.

Research Activities

1. Point-of-care device for sepsis management (Procalcitonin - based) - Technical Research Centre, Department of Science & Technology (Clinical PI: Dr Dinoop K P).
2. Role of novel Biomarkers and clinical Scoring systems in predicting progression to Sepsis in infected post-Cardiac Surgery patients (BioSSCaS study), funded by ICMR (Clinical PI: Dr Dinoop K P).
3. A prospective cohort study on cerebrospinal fluid diversion catheter-related infections in a tertiary referral neurosurgical care center, funded by ICMR, (Clinical PI: Dr Dinoop K P).
4. Development and Evaluation of Airborne infection control systems for healthcare facilities (Co-I: Dr Jyothi E K).
5. Ongoing Infective endocarditis Project (PI: Dr Kavita Raja).

New Initiatives

1. Application to start PDCC program in "Hospital Infection Control" in the Department of Microbiology accepted by Governing Body. There will be one seat per year, starting in Jan 2024.
2. Application to start PhD program in the Department approved by the Governing Body.



3. Antimicrobial stewardship committee was constituted, and Antibiotic Policy development was completed.
4. HICC sub-committees constituted.
5. As Transparency Officer, Dr Kavita Raja initiated the re-constitution of the Consultancy Committee of Key-stakeholders for advice on suo-moto disclosure which is part of the transparency policy of the Institute under Section 4 (2) of RTI Act 2005, which achieved 95 % transparency for the Institute in 2022, for the first time.
6. Joined KARSNET in the program to improve infection control practices in the hospitals in the state.
6. Commemoration of PoSH Act 2013 (by ICC) – A talk on World AIDS Day and two seminars in the week, followed by a function on Dec. 9, 2022, to honor Principal Medical College, Trivandrum, a lady who shared her experience as working as head of an institution followed by ‘He for She’ a talk on Women’s rights by Professor Manoj Krishna, Govt Law College, Trivandrum.
7. Women’s Day – As ICC chairperson, Dr Kavita Raja helped in organizing the Women’s Day celebration and gave a brief talk on the occasion. Two talks by eminent women in science and social work.

Awards and Honours:

1. Dr Dinoop K P was awarded the European Society of Clinical Microbiology and Infectious Diseases (ESCMID) observership grant 2022 - Awarded observership grant to visit the Antimicrobial Resistance and Healthcare-associated infections (AMRHAI) unit of the UK Health Security Agency (UK-HSA), Colindale, London.
2. Dr Jyothi E K Won first prize in regional-level Hindi Quiz conducted by TOLIC representing SCTIMST on Feb 24, 2023.

Events Organized

1. World Hand Hygiene Day - 5th May 2022 - Jointly with Hospital Infection Control Unit. Talk on NABH accreditation by Dr. Rajalekshmi, ID Physician, KIMS Hospital, Trivandrum, Quiz for Hospital staff and students, Best ICU and ward awards.
2. Training on RTI Act – Trainer- Mr Prakash Sejwal, IISTD conducted training for Office staff heads of all sections, scientists in BMT Wing, and hospital staff including HODs in Hospital Wing. Audit of the present information available on the website was conducted in the presence of the consultative committee on suo moto disclosure.
3. Talk on Biomedical waste management (IMAGE) – 15th October 2022.
4. World Antimicrobial Awareness Week – 18th to 24th November 2022.
5. WAAW posters, slogans competition, National Essay competition, Skit by MPH students on preventing AMR, Class for Link Nurses on their role in AMSP, Panel discussion on One-Health approach including experts from the veterinary and agriculture fields. Talk on preventing SSI by Dr. Victor Rosenthal, Miami, Florida, Founder of INICC, a global initiative for surveillance of HCAI.

Staff

Faculty

Dr Kavita Raja, Professor and Head
 Dr Dinoop K P, Associate Professor
 Dr Jyothi E K, Scientist C

Technical

Ms Soja Rani, Scientific Assistant
 Ms Smitha M, Scientific Assistant
 Mr Ranjith, Technical Assistant (lab)-B
 Ms Sudha Chandran R, Technical Assistant (lab)-B
 Ms Cinta Rose, Technical Assistant (lab)-A
 Ms Vandana, Technical Assistant (lab)-A
 Ms Beena, Transplant Co-ordinator-1, Homograft lab



World Hand Hygiene Day 5th May 2022



Figure 42: Valedictory Function and Talk by Dr Rajalekshmi, KIMS on NABH



Figure 43: Hand Hygiene demonstration by Contract worker and Poster display



Figure 44: Antimicrobial awareness- One health approach- Skit by MPH students

World Antimicrobial Awareness Week Nov 18th to 24th 2022



Figure 45: Valedictory Function of WAAW-2022. Fig 6. Essay Prize Winner –Dr Rajesh Kanna- AIIMS, Bibinagar



Figure 48: Kerala Antimicrobial Resistance Surveillance Program (KARSAP) meeting for implementing IPC in all hospitals in Kerala



Figure 46: Prize-winning posters- WAAW



Figure 49: Online Seminar on Surgical Site Infections by Dr Victor Rosenthal, Research Professor, University of Miami and the founder of INICC.



Figure 47: Panel Discussion with specialists from specialists from Veterinary sector and Fisheries



DEPARTMENT OF NEUROLOGY

The department provides comprehensive and multimodal care to patients with neurological disorders through its highly specialized divisions. The Department conducts General Neurology Outpatient Clinics daily from Monday to Friday as well as weekly Speciality Clinics for review of patients under different subsections.

During the year 2022-23, a total of 44,870 outpatients were consulted in General Neurology that included 38,696 reviews and 6174 new registrations, and 19182 patients were seen by the Speciality Clinics. The number of inpatients admitted was 3604. Thirty-three patients were diseased during the period.

The faculty and students have participated in many national and international conferences and received several prestigious awards during the year 2022-23. The Department continued to pursue major research projects and produced notable publications. The activities of the various subsections during the year are elaborated below:

NEUROLOGY INTENSIVE CARE UNIT

During 2022-2023, the Neuro-medical Intensive Care Unit (NMICU) treated 197 patients with critical neurological illness, with a survival rate of 97%. Demyelinating diseases (total 53, CNS and PNS demyelinating diseases accounting for 36 and 17, respectively) followed by Epilepticus/Autoimmune Encephalitis (total 22) were the most common diseases treated (Table 1 and Figure 50). Overall, Immune mediated Neurological diseases were far more common than other Neurological diseases and an increasing proportion was noted over the last few years. Table 2 and figure 50 shows the procedures performed in NMICU.

Table 1:

Diagnosis	Number
NMO/MOG associated disease	11
MS	10
LETM	8
Other primary CNS demyelination	7
Myasthenia gravis	10
Meningitis	3
CNS Opportunistic infection	2
Status epilepticus	11
Autoimmune encephalitis	11
GBS	15
CIDP	2
Primary CNS malignancies	3
Sepsis and septic encephalopathy	9
Developmental epileptic encephalopathy	7
Myopathy	3
APLA Syndrome	2
CVT	4
Hypertrophic pachymeningitis	2
Reversible cerebral vasoconstriction	2
Ischaemic Stroke	54
Haemorrhagic Stroke	11
Others	10
Total	197



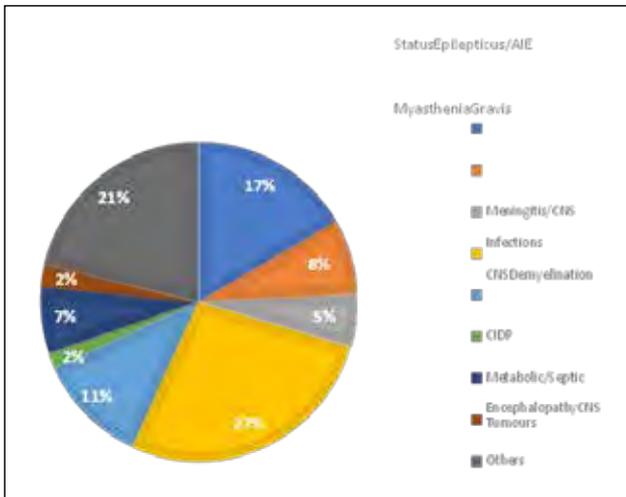


Figure 50: Neurological diseases treated in the Neuromedical ICU in 2022-2023 (excluding stroke)

Table 2: Procedures performed in NMICU.

PROCEDURE	NUMBER
Plasmapheresis	43
IVIg	17
Rituximab	40
Cyclophosphamide	5
Epidural blood patch	1
Alemtuzumab	1

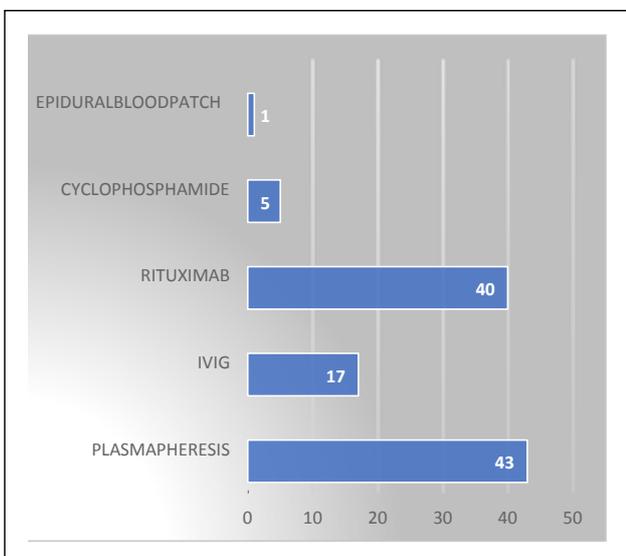


Figure 51

COGNITION AND BEHAVIOURAL NEUROLOGY SECTION

The section provides clinical services to children and adults with cognitive problems in disorders like: - MCI, Dementia, Epilepsy, Alzheimer's Dementia, stroke, learning disability, developmental delay, post-operative cognitive problems. It conducts memory and neurobehavioral disorders clinic every week. It also provides advice and technical support to the Alzheimer's & Related Disorders Society of India (ARDSI), a voluntary organization that helps dementia patients and care givers. The section carries out clinical & basic science research in the field of Dementia, Cognition and Behaviour, and Traumatic Brain Injury

Activities

Research Activities completed

- ◆ The Influence of Sleep Architecture on the Severity of Memory Disruption in Amnesic Mild Cognitive Impairment.
- ◆ Validation of memory fMRI paradigms and its utility in pre-surgical evaluation of patients with Refractory Temporal Lobe Epilepsy (TLE).
- ◆ Development and validation of a comprehensive clinical and neuropsychological battery for use in the Indian context for patients with Vascular Cognitive Impairment.
- ◆ Non-Linear Analysis of EEG Signals of Patients with Alzheimer's Disease.
- ◆ The human brain mapping project a resting state fMRI study of healthy controls and patients with mild cognitive impairment (MCI) & degenerative dementia of the Alzheimer's type (AD).
- ◆ Cognitive Assessment of patients with minor stroke and subtyping of cognitive impairment following stroke in collaboration with the Comprehensive Stroke Care Centre.



- ◆ Control based validation of neuropsychological test batteries for material specific memory impairment in patients with medically refractory temporal lobe epilepsy due to hippocampal sclerosis.
- ◆ Effect of yoga on neuropsychological functions and brain connectivity networks in mild cognitive impairment and cognitively normal subjects.

(BIN), Kolkata, National Brain Research Centre (NBRC), Manesar and University of Calcutta, Kolkata, funded by the DBT.

6. Effectiveness of a Supervised Aptitude-based Cognitive Retraining intervention in mild cognitive impairment and Early Dementia due to Alzheimer's disease- The SACRED study, funded by DHR.

Details of Ongoing Projects

1. Unit of CBNS has collaborated with NIMHANS for submitting a proposal on a multi centred project titled The Development of standardized “cognitive computing” based online tools for the diagnosis of cognitive impairment in Indian languages submitted to DST by Dr Ramshekhar N Menon.
2. Genetics of complex Paediatric epilepsy syndromes: electro-clinic imaging-based genotype - Phenotype correlations in an Indian cohort” in collaboration with Rajiv Gandhi Centre for Biotechnology, Trivandrum.
3. Significance of ion channel single nucleotide polymorphisms in children with epileptic encephalopathies- a pediatric cohort study (ICMR-RA), funded by the ICMR.
4. Emotion processing in AD, MCI and healthy individuals and its implications in medial temporal lobe degeneration assessed from structural and functional brain MRI indices in concurrence with neuropsychology (ICMR -SRF).
5. The AADAR Dementia Science Programme titled “Dementia Science Programme: Incidence/ Prevalence/ Risk/ Intervention analysis of dementia and basic research thereof”- Multicentre study in collaboration with, All India Institute of Medical Sciences (AIIMS), New Delhi, National Institute of Mental Health and Neuro Sciences (NIMHANS), Bengaluru, Bangur Institute of Neurosciences

Clinical Activities

CBNS has introduced speciality patient care services to non- pharmacological treatment of Autism, Specific Learning Disability and included cognitive retraining for post-operative paediatric group in 2022. CBNS has extended its post-operative rehabilitation services to Dept. of Paediatric Cardio Vascular Thoracic Surgery.

The patient care services of MNC in detail:

Speech and Language Evaluation –1350

Speech therapy – 610

Dysphagia Assessment – 502

Neuropsychological Testing –750

IQ/DQ Assessments –48

Counselling Sessions –22

Memory & Neurobehavioral Clinic Attendance – 610

Cognitive Retraining-57

New Initiatives

The CBNS unit has extended its research resources to Traumatic Brain Injury and expanded the existing cognitive retraining resources. The unit is also entering to cognitive retraining under Dr. Ramshekhar N Menon.

Events Organized

World Alzheimer's Month -2022: An Observance and Contact Program for the Patients and Caregivers was held on 22nd September at Swasthy Convention Hall, SCTIMST. The theme of 2022 was “Know Dementia, Know Alzheimer's”. Awareness posters were displayed at the Neurology OPD. 50 participants



comprising of patients and caregivers attended the program. Informative sessions that raise awareness about the importance of early diagnosis, management, research and rehabilitation in Dementia, were held by the faculty of the Department. Following the sessions, a panel discussion session was held to address the queries. Cognitive retraining activities were also organized for the patients.

CME: Dr Jacob Roy Memorial CME was organized by ARDSI, Trivandrum Chapter in Collaboration with Department of Neurology, SCTIMST on 18th December at AMCHSS Auditorium. The theme of 2022 was “Cognitive Assessment in Adults”. Academic sessions were handled by esteemed faculty from SCTIMST and other prestigious institutions. Following the sessions, case presentations were made by Senior Residents from various institutions.

Staff

Neurologist

Dr Ramshekhar N Menon, Professor

Neuropsychologists

Ms Sushama S R

Speech Therapists

Dr Manju Mohan P

Ms Vipina V P

Social Worker

Ms Anjali S Suku

COMPREHENSIVE CARE CENTRE FOR MOVEMENT DISORDERS

The comprehensive care centre for movement disorders (CCCMD) serves patients with Movement Disorders that include Parkinson’s disease, other Parkinsonian disorders, various tremor disorders and some conditions such as chorea, dystonia. The CCCMD provides comprehensive medical and surgical care to patients affected with Movement Disorders and trains Neurologists in their diagnosis

and management. The centre is also involved in research projects pertaining to Movement Disorders and an R&D project collaborating with the Biomedical Technology Wing of the Institute. Three students are currently doing their PhD projects in Movement Disorders, with the support of CCCMD. The centre also provides training to one post-doctoral fellow.

Activities

Clinical Activities

The clinical activities of CCCMD include out-patient clinic services (A weekly movement disorders specialty clinic), Deep Brain Stimulation Programming Clinic, Botulinum Toxin Injection Clinic and Movement Disorders surgical programme. During the year 2022-23, 612 new patients with various movement disorders were registered for the services of the section. There were 2491 review clinic visits by patients, in the Movement Disorders clinic. In addition, 252 patients sought out-patient clinic review through the tele-medicine facility. Seventy-six patients visited for Deep Brain stimulation (DBS) programming and other surgical assessments. There were 447 patient visits for Botulinum Toxin injections, in the Botulinum Toxin Injection clinic. Thirty-Six functional neurosurgical procedures were performed, including deep brain stimulation surgeries and IPG replacements. One of the patients who underwent DBS surgery was implanted using specialised “Directional Leads” capable of current steering in the brain in specific directions and also ability to modify stimulation based on feedback signals from the brain.

Research Programmes

Several externally funded research projects are ongoing in the section. An international multi-centre research project, funded by the Michael J Fox foundation, USA, titled “Genetic Architecture of Parkinson’s disease in India,” is a Genome-wide Association study (GWAS) aimed at exploring the genetic factors predisposing to Parkinson’s disease in the Indian population and is the first of its kind from India. There are around 20 centres participating from across India to ensure a pan-Indian representation for the study population. A second externally funded



collaborative research project, funded by ICMR aims to identify the differences in the gut microbial flora between patients with Parkinson's disease and healthy subjects and the relationship of the microbial flora pattern with metabolomic profile of body fluids, in patients with Parkinson's disease. Cochin University of Science and Technology (CUSAT) is the collaborator for this project, for microbial and metabolomic studies and bio-informatics. The project is titled "Exploring the human gut microbiome and metabolome in health and in Parkinson's disease - a window to the Gut-microbiota- brain axis alterations in Parkinson's disease". (Figure 1) A third externally funded project- "Spiral Dx- Tremor Diagnosis and Quantification using Artificial Intelligence"- is a multi-centre collaborative project funded by the Department of Biotechnology (DBT), Government of India. This project aims to develop an artificial intelligence algorithm to identify various tremor subtypes easily, by analysing the characteristics of spirals drawn by the patients on paper / a digital surface interface device (a tablet computer). A fourth project, funded by the Movement Disorders Society of India (Clinical Registry of Movement Disorders) is aimed at forming a systematic database of patients with Movement Disorders, to facilitate clinical research.

CCCMD participates as the clinical collaborator of an R&D project for the indigenous development of Deep Brain Stimulator System. This project, funded by the DST, is carried out by the Biomedical Technology Wing of the Institute. Bhabha Atomic Research Centre (BARC) is also a collaborator for this project, providing technical support for the sophisticated electronic circuitry involved. Animal implantation experiments are expected soon.

The CCCMD is also involved in externally funded research projects, collaborating with Biochemistry Department, and aimed at addressing the pathogenic mechanisms and biomarkers of Parkinson's disease. A project titled "Identification and Characterization of Ubiquitin and SUMO-modified exosome proteins from Parkinson's disease patients' blood" is funded by the ICMR and is ongoing. This project explores the potential of exosomal cargoes in blood as biomarker

for Parkinson's disease. A second project aimed at measuring glucocerebrosidase activity for monitoring lysosomal functions in Parkinson's disease, has been approved by ICMR, funds have been received and has been initiated.

There are three scholars doing their PhD currently, attached to CCCMD, in Movement-disorders related areas. One of them is directly guided by the faculty of CCCMD and explores the connectivity between basal ganglia and cerebellum in healthy subjects and the alterations in Parkinson's disease, using advanced functional MRI-based techniques (Figure 2 and Figure 3). A publication has already come out of this project, in a high impact journal. A second PhD scholar works on an R&D project aimed at development of a Deep Brain Stimulation lead able to sense abnormal signals from Parkinson's disease brain so that adaptive Deep Brain Stimulation can be given. The third PhD scholar works on exosomal cargoes as biomarkers for Parkinson's disease.

There are Institute-funded and several non-funded research projects which are ongoing, in addition to the funded projects discussed above. These include "Unravelling the clinical and genetic spectrum of Neurodegeneration with Brain Iron Accumulation" (SCTIMST funded) and others that address various aspects of movement disorders like surgical complications of Deep Brain stimulation, hurdles and obstacles to DBS surgery in the Indian perspective, clinical profile and temporal evolution of isolated dystonia, pain as a non-motor symptom in Parkinson's disease and impact of DBS on survival in Parkinson's disease.

New Initiatives

The centre has completed nearly 300 Deep Brain stimulation (DBS) surgeries for various movement disorders. Patients with DBS implants need periodic meticulous follow-up and fine tuning of stimulator settings; with the increasing number of post-surgical patients, it had become increasingly challenging to cater to these patients in the regular Movement Disorders Review clinic. The centre has therefore started a new follow-up clinic exclusively for patients



who have undergone Deep Brain Stimulation Surgeries. This DBS Follow-up Clinic is functioning from November 2022, on the second and fourth Monday of every month.

Events Organized

The CCCMD, in collaboration with the NGO, Seva India, organized an online awareness program for patients with Parkinson’s disease on April 11, 2022, in connection with world Parkinson’s day. This was subsequently streamed in YouTube and was widely appreciated by patients and care givers. Another talk was given for the public, on Parkinson’s disease and its management, in FM Radio (Red FM).

Awards and Honours

- ◆ Dr Syam Krishnan, Dr Divya KP and Mr Vineeth R (PhD scholar) received travel grant awards

to participate and present research papers in the International Parkinson and Movement Disorders Congress, held in Madrid, Spain (September 15-18, 2022).

- ◆ Dr Divya KP won the Leadership Program (LEAP) award 2022 from the International Parkinson and Movement Disorders.

Staff

Faculty

- Dr Syam K, Professor
- Dr Divya K P, Associate Professor

Technical

- Mr Gangadhara Sarma S, Psychologist

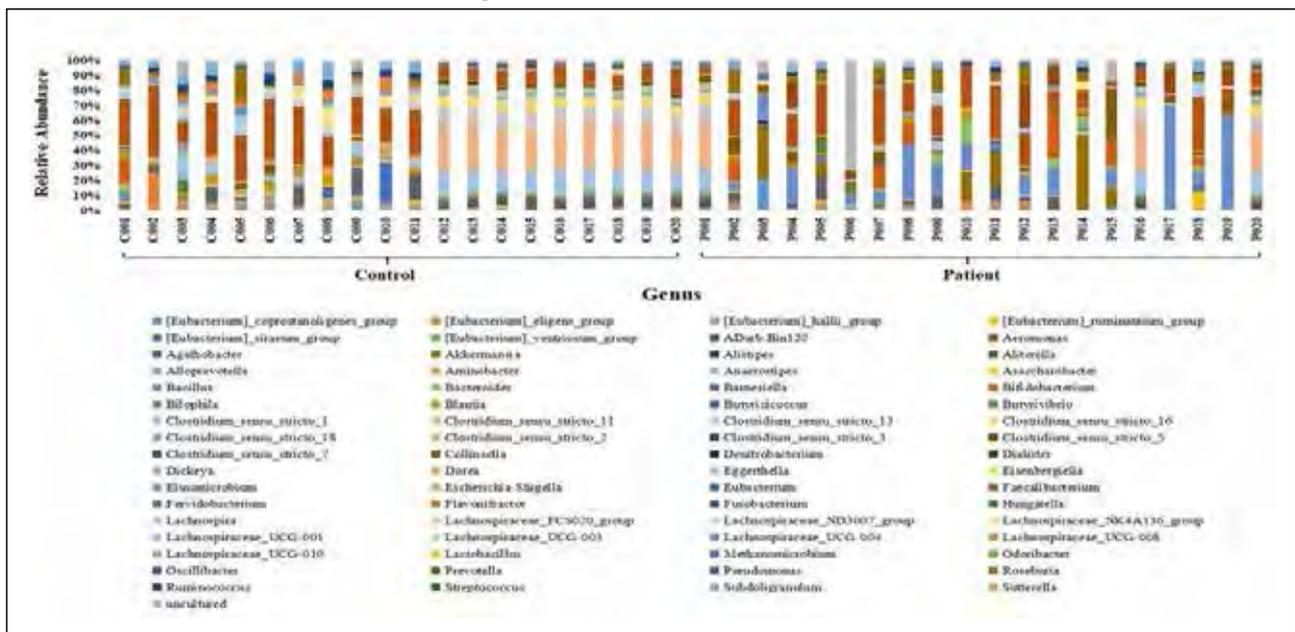


Figure 52: A collaborative research project undertaken by CCCMD and funded by the ICMR explores the differences in the pattern of bacterial commensals in the gut, between patients with Parkinson’s disease and healthy people. The figure depicts a histogram representation, showing the relative abundance of types of bacteria at the genus level. Bacteria belonging to the types Actinobacteriota, Bacteroidetes, Proteobacteria and Verrucomicrobia are significantly increased in PD and Firmicutes, Campilobacterota, Chloroflexi, Cyanobacteria and Halobacterota were found more in healthy volunteers



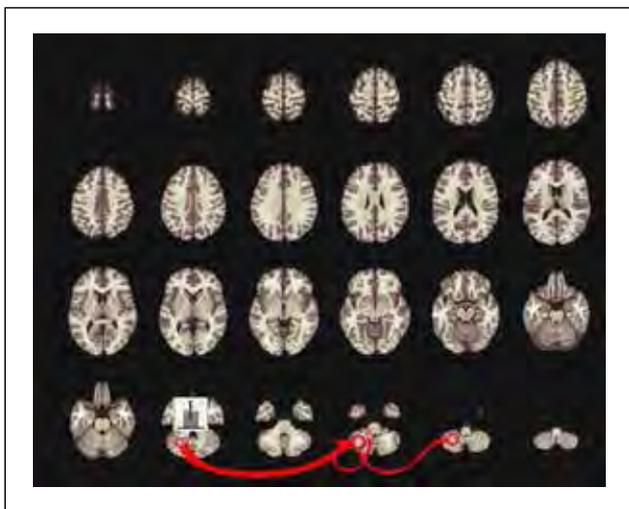


Figure 53: A research project in the CCCMD that explores the alterations in the connectivity between different areas in the cerebellum and basal ganglia structures in different stages of Parkinson's disease compared to healthy people. The figure shows increased functional connectivity between cerebellar cortical regions and the dentate nucleus in healthy people compared to Parkinson's disease patients in non-medicated state.

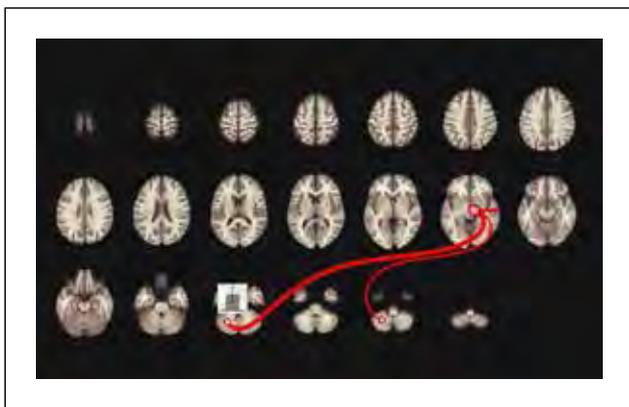


Figure 54: Another set of results from the same research project shown in Figure 2. This figure shows increased functional connectivity between right subthalamic nucleus and two areas of the left half of cerebellum – lobules C7b and crus 2- in the medicated state compared to non-medicated state in Parkinson's disease.

COMPREHENSIVE CENTRE FOR SLEEP DISORDERS

Division is involved in mainly clinical care of patients with sleep disorders on outpatient basis, by running weekly sleep clinic. In addition, we have a 2 bedded Level 1 Polysomnography lab and regularly perform diagnostic PSGs and MSLTs. Furthermore, we offer consultation services to other departments like Cardiology and Neurosurgery for patients admitted with heart failure, AF and sleep related disorders.

Activities

Clinical Activities

- ◆ Sleep outpatient clinics-every Thursday 2 pm

Overnight sleep studies and Multiple sleep latency test -in Sleep lab

Clinical activity	Numbers
OPD attendance	408
Diagnostic sleep studies	150
MSLTs	3

Research Programmes

We have initiated a study titled "Cardiac signals for sleep apnoea prediction in ischaemic stroke patients" in collaboration with Electronics and Electrical engineering department of NIT-Calicut, for which institute has entered into an MoU with NIT-C.

Events Organized

The division organized a Polysomnography workshop on 12th November 2022 which consisted of 7 didactic lectures and hands-on training session using 4 stations for the participants. There were 80 participants in the workshop-including 41 doctors and 39 technologists.

The division organized World Sleep Day 2023 along with Division of Sleep research, BMT wing and Nursing division on 17th March 2023 at the hospital wing on the theme "Sleep is essential for Health". The event included distribution of 2 CPAP machines to our patients free of cost, which was donated by a patient



of sleep clinic who had benefitted from CPAP therapy and 3 lectures on sleep and brain health, cardiac health and public health aspect. A poster competition was held on the theme for staff and students of the Institute and prize winners were honoured during the event, with display of posters in patient care areas.

Staff

Faculty

Dr Sapna Erat Sreedharan, Professor
Dr Ashalatha R, Professor (on-leave).

Technologists

Mr Anees C A
Mr Pradeep M J
Ms Shana N Nair
Ms Deepa Paul,
Ms Maneesha M M
Medical Social Worker
Mr Ranjith P K



Figure 55: World sleep day- Patient awareness program. Above photos are from Polysomnography workshop.



COMPREHENSIVE STROKE CARE PROGRAM

The comprehensive stroke care centre provides all-inclusive care for patients with stroke. It is a 11 bedded unit with seven ICU beds and four ward beds. It has state of the art facilities which include intravenous thrombolysis, mechanical thrombectomy, carotid endarterectomy and stenting, decompressive craniectomy for malignant stroke and Moya Moya revascularization surgery. The stroke team involves neurologists, neurosurgeon, vascular surgeon, neuroanesthesiologists, interventional radiologists and cardiologist. Comprehensive rehabilitation services are also rendered to the patients in the unit.

Activities

Research Activities

◆ Ongoing Projects

- a) Establishment of the Indian Stroke Clinical Trial Network (INSTRUCT) PI – Dr P N Sylaja, Funding agency – ICMR.
- b) A whole exome sequencing study to identify novel gene variants in Moyamoya disease in Indian population. PI – Dr P N Sylaja, Funding agency -ICMR.
- c) Prospective registry for assessment of acute ischemic stroke patients treated with neurothrombectomy devices in India (PRAAN) – PI – Dr P N Sylaja, Funding agency – Medtronic
- d) Development of Hospital Based Stroke Registries (HBSR) in different regions of India. PI – Dr P N Sylaja, Funding agency - National Centre for Disease Informatics and Research, Indian Council of Medical Research.
- e) Medication adherence and management of risk factors for secondary prevention using smart phone-based application-feasibility study. Co-PI – Dr P N Sylaja, Funding

agency – World Stroke Organization

- f) A Comprehensive Framework for Treatment of Impairment of Upper Extremity due to Stroke by Combining Computational Modeling and Virtual Reality. PI – Dr P N Sylaja, Funding agency:UAY scheme of IIT Chennai and MHRD in collaboration with IIT Chennai, IITM Hyderabad and TCS.
- g) Implementation of best practice stroke care in India. Collaboration with University of Lancashire Role: PI – Dr P N Sylaja, Funding agency: National Institute for Health Research (NIHR), UK.
- h) Prevalence of atrial cardiopathy in cryptogenic stroke in comparison with stroke of known etiology- prospective study: PI: Dr Sapna Erat Sreedharan. Funding Agency: ICMR.
- i) Community health worker based secondary prevention in community for stroke patients in Kollam district. Role: PI – Dr P N Sylaja, Funding Agency: Government NCD program.

◆ Completed Projects

- **Extramural funded projects (completed)**
 1. Early vs late initiation of direct oral anticoagulation in post ischemic stroke patients with AF (ELAN). Role: PI – Dr P N Sylaja, Funding agency: Inselspital University Hospital, Bern.
 2. Ayurvedic treatment in the rehabilitation of ischemic stroke patients in India-A randomized controlled trial (RESTORE trial) (June 2018 – March 2022) Role- National PI – Dr P N Sylaja, Funding agency – ICMR.
 3. Secondary Prevention by Structured Semi-Interactive Stroke Prevention Package in INDIA (SPRINT INDIA) Study Role: PI – Dr P N Sylaja, Funding agency – ICMR.



4. Improving stroke care in India - Advancing the INSTRUCT operations and Network (IMPROVIZATION)- Role: PI – Dr P N Sylaja, Funding agency: National Institute for Health Research, UK This project is collaboration with University of Lancashire UK.
5. Premorbid nutritional status and development of a nutritional software for ischaemic stroke patients. Funding agency: Agricultural College, Vellayani (Oct 2018-Oct 2019) Role: Dr P N Sylaja-PhD Co-Guide.
6. Prevalence of atrial cardiopathy in cryptogenic stroke in comparison with stroke of known etiology- prospective study. Principal Investigator: Dr Sapna Erat Sreedharan. Funding agency: Kerala Association of Neurology.

Clinical Activities

Routine clinical activities are summarised below:

Areas / Procedures	No of Patients
Stroke Clinic Attendance (Direct)	3048
Stroke Clinic Attendance (Teleconsultation)	224
Stroke unit admission	520
Carotid Endarterectomy	42
Carotid Stenting	1
IV thrombolysis	48
Mechanical Thrombectomy	34
Moya-Moya Revascularization	15
Decompressive Hemicraniectomy	9
Hematoma Evacuation	3
Cerebellar decompression	3

Events Organized

- a) Asian Stroke Summer School 2022 (ASSS 2022), a four-day teaching course which involved the acute interdisciplinary stroke treatment was conducted from 08th to 11th December at O by Tamara, Thiruvananthapuram. The previous editions of this training programme were conducted mostly in European nations and this is the first time the event is held in India. ASSS 2022 was organised by Comprehensive Stroke Care Programme and the Department of Imaging Sciences and Intervention Radiology at the Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST) in collaboration with the University of Bern, Switzerland. Smt. Veena George, Honourable Minister for Health and Family Welfare, Government of Kerala inaugurated, Dr V P Joy, Chief Secretary, Govt of Kerala was the Chief guest and Dr Sanjay Behari, Director SCTIMST delivered the Presidential address in the inaugural ceremony.

Dr P N Sylaja, Professor and Head of Neurology, In-Charge, Comprehensive Stroke Care Program, SCTIMST, Dr E R Jayadevan, Professor, Department of Imaging Sciences & Interventional Radiology (ISIR), In charge of Neuro Intervention Centre SCTIMST, Dr Urs Fischer, Professor of Neurology, Chairman, Department of Neurology, University Hospital Basel, Switzerland and Dr Jan Gralla, Professor and Head of Neuroradiology, Neurocenter, Inselspital, Bern, Switzerland were the course directors of ASSS 2022. The 12 international faculties and 35 national faculties were involved in delivering hands-on training for neuro interventionists and teaching sessions for stroke physicians.

- b) The “Ayurvedic Treatment in The Rehabilitation of Ischemic Stroke Patients in India: A Randomized Controlled Trial (RESTORE)” which is funded by Indian Council for Medical Research (ICMR), New Delhi. The study is centrally coordinated by the Comprehensive stroke care program, SCTIMST with four centres across India and was initiated in April 2019. The



study has attained target recruitment of 140 patients and was completed on 29th November 2022. The RESTORE trial investigator meeting was held on 19th February 2023 at The Hotel Residency Tower, Thiruvananthapuram from 09:00 am to 02:00 pm. The trial results were presented during the meeting. The meeting was attended by Dr Meenakshi Sharma, Scientist F on behalf of ICMR, New Delhi, site Principal Investigators, Co-Investigators, Ayurveda Investigators, and Site coordinators from all the study sites.

Awards and Honors

- a) Dr Sylaja P N was elected as the Board of Directors of the World Stroke Organization.
- b) Dr Sylaja P N was nominated as Women of Stroke 2022 by the World Stroke Organization.
- c) Ms Soumya Krishnamoorthy has completed her PhD under the guideship of Dr P N Sylaja.
- d) Dr P N Sylaja received the second place for the National Level World Stroke Day Activities by Indian Stroke Association which was given during the 15th Indian National Stroke Conference 2022 on 17th April, 2022 at Mumbai.
- e) Dr Sapna EratSreedharan received first prize for the stroke quiz organised during the 15th Indian National Stroke Conference 2022 on 17th April, 2022 at Mumbai.
- f) Dr Naveen Kumar P, Post Doctoral Fellow in Stroke won the third prize in AOCN-IANCON International Quiz competition held in Delhi.
- g) Mrs Soumya Krishnamoorthy, PhD scholar has received the Annual award for laboratory research in Neuroscience for the abstract titled “Biomarkers predict hemorrhagic transformation on stroke severity in Acute ischemic stroke patients” at the 29th Annual Conference of Indian Academy of Neurology in Delhi held on 3rd-6th November 2022.
- h) Mrs Soumya Krishnamoorthy received Young Investigator award for the abstract titled “Soluble ST2 is a predictor of poor functional outcome in acute ischemic stroke” submitted for the 14th World Stroke Congress on 26th -29th October, 2022 at Singapore.
- i) Dr Manish K Y received Young Investigator award for the abstract titled “Prevalence, predictors and outcome of stuttering lacunar stroke” submitted for the 14th World Stroke Congress on 26th -29th October, 2022 at Singapore.
- j) Dr Naveen Kumar P, Post Doctoral Fellow in Stroke has won one the best free papers for the paper titled “Correlation between Pulsatility Index in Transcranial Doppler and Post Stroke Outcomes in patients with Acute Lacunar Strokes” in the Travancore Neurocon, 2022, the annual conference of the Neurological Society of India-Kerala chapter (Kairaly Neurosciences Society) held on 08/05/2022.
- k) Dr Manish K Y has won the best award paper for the paper titled “Prevalence, Predictors and Outcome of Stuttering Lacunar Strokes” in the Travancore Neurocon, 2022.
- l) Dr Jithin George has won one of the best free papers for the paper titled “Predictors of Outcome and Recurrence Risk in Embolic Stroke of Undetermined Source” in the Travancore Neurocon 2022.
- m) Ms Rinta Paul, PhD scholar under the guideship of Dr P N Sylaja has received the Young Investigator Award for the abstract titled “Feasibility and efficacy of virtual reality rehabilitation for the treatment of impairment of the upper extremity due to ischemic stroke: A pilot randomised controlled trial” at the 11th Annual Conference of Indian Federation of Neurorehabilitation (IFNRCON 2023).
- n) Dr Avinash Kulkarni received 3rd prize for the paper presentation titled “Sleep dysfunction after ischemic stroke-prevalence, predictors and short



term outcome” at the Indian National Stroke Conference (INSC 2023) held on 30th March, 2023 to 2nd April, 2023 at ITC Grand Chola, Chennai.

- o) Dr Nandana J received 1st prize for the poster presentation titled “QT interval changes in acute ischemic stroke and its correlation with stroke severity and subtype” at the Indian National Stroke Conference (INSC 2023) held on 30th March, 2023 to 2nd April, 2023 at ITC Grand Chola, Chennai.

Staff

Faculty

Dr P N Sylaja, Professor and Head

Dr Sajith S, Professor

Dr Sapna Erat Sreedharan, Professor

Social worker

Ms Sreelakshmi R S, Social Worker – B



Figure 56: Asian Stroke Summer School



NEUROMUSCULAR AND MULTIPLE SCLEROSIS DIVISIONS

The Divisions render services to patients suffering from two broad groups of disorders: (a) Neuromuscular disorders which include anterior horn cell diseases, neuropathies, inflammatory myopathies, genetic muscle diseases including muscular dystrophies and neuromuscular junction disorders (b) Acquired central nervous system demyelinating disorders like multiple sclerosis and neuromyelitis optica spectrum disorders. The patient care services include a weekly Neuromuscular clinic and monthly Multiple Sclerosis clinic. The team also routinely caters to the care of patients with neuromuscular disorders and central nervous system demyelinating diseases admitted in the neurology wards and intensive care unit.

Activities

The Neuromuscular clinic functions on Tuesday of every week. In 2022-23, the clinic recorded 2054 patient visits. The Multiple Sclerosis (MS) Clinic recorded 42 patient visits during the same period.

The summary of studies conducted in the electrophysiology lab in 2022-23 is given below:

Table 1: Electrophysiological studies conducted in 2022-23

Study	Number
Nerve conduction studies	1379
Electromyography	740
Repetitive nerve stimulation	150
Single fibre electromyography	27
Blink reflex	27
Visual evoked potential	314
Brainstem auditory evoked potential	53
Somatosensory evoked potential	123

The faculty and fellow participated in several national and international conferences in 2022-23. Dr Aravinda Mandalapu, PDF Neuromuscular Disorders, presented the two papers in national conferences. She made two conference presentations during her

tenure: (a) 'Guillain-Barre syndrome mimics: clinico-electrical profile from a tertiary care centre' in the 5th conference of the Neurophysiology subsection of the Indian Academy of Neurology (IAN-CNPCON) in September 2022 and (b) 'Therapeutic response of subgroups of idiopathic inflammatory myopathy' was presented for 18th Asian Oceanian Congress of Neurology and 29th Annual conference of the Indian Academy of Neurology in November 2022. She secured first place for platform presentation for her presentation in IAN-CNPCON 2022. Ms Jisha S, Diploma in Neuronursing student, collaborated with the division for her paper on adherence to disease modifying therapies in multiple sclerosis for which she secured first prize for scientific paper presentation at SINNCON 2022, the 42nd national annual conference of the society of Indian Neuroscience Nurses held in December 2022 at Agra.

Dr Sruthi S Nair completed an international fellowship in multiple sclerosis from 1 July to 31 October 2022 at Queen Elizabeth Hospital, Birmingham, United Kingdom which was funded through the Multiple Sclerosis International Federation (MSIF) Du Pre Grant. She is the co-guide for Dr Renjumol V S, Assistant Professor in the Swathavritta Department, Government Ayurveda College, Tripunithura who initiated PhD under Kerala University of Health Science in 2022. Dr Sruthi also participated as faculty in 13 national conferences and contributed to a public awareness article on 'Diseases and problems leading to memory loss' in 2022-23.

Research Programmes

SCTIMST is one of the nodal centres for the three-year multicentric project 'Indian multiple sclerosis and allied demyelinating disorders registry and research network' funded by Indian Council of Medical Research was initiated in August 2021. Newly initiated intramural projects included studies on idiopathic inflammatory myopathies and immune responsive axonal neuropathies.

New Initiatives

Free medicines for multiple sclerosis is being supplied by Kerala Social Security Mission, Government of



Kerala with SCTIMST as one of the nodal centres. The drug distribution was initiated in the second half of 2022.

Honours and Awards

Dr Sruthi S Nair was awarded the Multiple Sclerosis International Federation Du Pre Grant to pursue an international fellowship which was completed in 2022.

Dr AravindaMandalapu, PDF Neuromuscular Disorders, secured first place for platform presentation for her presentation in IAN-CNP CON 2022.

Diagnosis	Number
Autism Spectrum Disorder	159
Intellectual disability	125
Global developmental delay	189
Specific learning disorder	19
Attention deficit hyperactivity disorder	194
Cerebral palsy	73
Other childhood neurological disorders	281
Total	737

PAEDIATRIC NEUROLOGY DIVISION

The paediatric neurology and neurodevelopmental disorders subdivision focuses on the evaluation and management of children with neurological disorders. Paediatric neurology cases are managed as out-patients and in-patients in the wards and intensive care unit. ‘Comprehensive Care Centre for Neurodevelopmental Disorders (CCCND)’ under this subdivision provides multidisciplinary management for children with Autism Spectrum Disorder, Attention Deficit Hyperactivity Disorder, Intellectual Disability, Cerebral Palsy, etc. A specialty clinic for autism and other neurodevelopmental disorders are conducted every first and third Saturday of a month. Paediatric neurology meet is conducted twice a month to discuss the management of complex cases. Academic sessions are conducted regularly at CCCND which includes seminars, case discussions and journal club. Two extramural funded projects and four non funded project were conducted during this year. One Junior research fellow was trained in functional neuroimaging in autism spectrum disorders.

Activities

Clinical Activities

283 cases were admitted in the paediatric neurology ward last year and 397 cases were seen in the autism clinic. There were 1040 patients who sought services from CCCND and the distribution of cases is given in below:

Protocols for swallow assessment for children, gross motor training, balance training, physiotherapy muscle strengthening, group therapy for autism spectrum disorder and physical therapy for Duchenne Muscular dystrophy was developed. Patient management conference was conducted twice a month for discussing and formulating the treatment plan in children with complex neurological disorders. Review and appraisal meeting were held once a week to discuss the previous week’s activities of CCCND and to plan the activities of the subsequent week. Regular academic presentations including seminars, journals and case discussions were conducted at CCCND.

Research Programmes

2 Extramural funded projects and 5 non funded projects are ongoing at the paediatric neurology subdivision.

- i) “Emotional Face Recognition Understanding the underlying Neural connectivity in High functioning adolescents with autism” funded by Cognitive Science Research Initiative (CSRI) of DST. Principal Investigator—Dr Sowmya Sundaram .
- ii) “Establishing Comprehensive Care Centre for Neurodevelopmental Disorders (CCCND)” funded by Federal Bank Hormis Memorial Foundation, Corporate Social Responsibility (CSR) wing of Federal Bank Ltd. Principal Investigator—Dr Sowmya Sundaram.



- iii) Unmet needs and services used by children with autism spectrum disorders.
- iv) Clinical and etiological profile of neurodevelopmental disorders—a single centre experience.
- v) Clinical outcome, literacy skills and academic achievement in autism spectrum disorder: a prospective cohort study.
- vi) Clinical profile of leukodystrophies and genetic leukoencephalopathies in children and adults in India.
- vii) Validation of Malayalam translation of broad autism phenotype questionnaire and assessment of the autistic traits in parents of children with autism spectrum disorder.

New Initiatives

An extramural funded project titled 'Functional near-infrared spectroscopy—an exploratory cross-sectional study on clinical utility in the evaluation of autism and other neurodevelopmental disorders' was approved by Indian Council of Medical Research.

Events Organized

- ◆ A four-day online certification workshop on 'Autism Diagnostic Observation Schedule-II' (ADOS), a gold standard test in the diagnosis of autism spectrum disorder in online mode was conducted from 08th to 11th of November, 2022. The speaker was Ms. Emma Woodhouse, a Neurodevelopmental specialist and certified ADOS trainer. This workshop was attended by 20 participants.
- ◆ Observance and care giver contact program for parents of children with Dravet syndrome—a problematic childhood onset epileptic encephalopathy was conducted on the occasion of World Dravet syndrome Month- June 2022. 40 families participated in this online meeting which spread the awareness and management aspects of Dravet syndrome.

- ◆ Autism day awareness program was organised on April 2 and 4, 2022 and conducted an online parental awareness session along with talent show and distribution of gifts to children with special needs.

Awards and Honours

- ◆ Dr Soumya Sundaram was invited as an expert member of the Department of Biotechnology's initiative on a comprehensive network program to enable research on autism spectrum disorders.
- ◆ Dr Soumya Sundaram received International Child Neurology Congress (ICNC2022) bursary/travel grant for presenting E poster titled 'Broad Autism Phenotype Questionnaire— Translation and Validation in a South Indian language followed by pilot study' in 17th International Child Neurology Congress 2022 (ICNC 2022), Antalya, Turkey on 3-7, October, 2022.
- ◆ Ms. Sajitha KV (SLP), Mr Akhil S.L (SLP) and Ms Betsy Baby (Psychologist) received certification for four-month course on "Demystify Learning Disability" conducted by Aster Medcity, Kochi.

Staff

Faculty

Dr Soumya Sundaram, Additional Professor
Dr Ramshekhar N Menon, Professor

Technical

Ms Ajina Khan, Physiotherapist
Mr Akhil SL, Speech and language pathologist
Mr Aneesh A, Occupational Therapist
Ms Betsy Baby, Psychologist
Ms Rekha M, Social worker
Mr Ritwik TA, Psychologist
Ms Sajitha KV, Speech and language pathologist



R MADHAVAN NAYAR CENTRE FOR COMPREHENSIVE EPILEPSY CARE

R MadhavanNayar Centre for Comprehensive Epilepsy Care (RMNCEC) provides comprehensive care for all types of adult and paediatric epilepsies to patients from all parts of India and the neighbouring countries. It is the main Centre for epilepsy surgery in India and South-east Asia and offers world-class yet affordable comprehensive epilepsy care, comparable to any other centre in the world. The mission of the Centre is as follows: (1) to provide comprehensive medical, surgical, psychosocial and occupational care for patients with epilepsy with a special emphasis on the surgical treatment of medically refractory epilepsies, (2) to undertake advanced clinical and basic science research in various areas of epilepsy, (3) to enhance epilepsy awareness among the primary care physicians and general public and (4) under the subsection of Kerala Registry for Epilepsy in Pregnancy (KREP) to address issues pertaining to women with epilepsy

Activities

During the year, the Centre completed 104 epilepsy surgeries to become the first and only Centre in India to have completed more than 2487 epilepsy surgeries.

Video EEG monitoring - 287

Epilepsy surgery -107

WADA test -2

Epilepsy clinic attendance (EP1+EP2)-6220

KREP clinic attendance -529

Epilepsy Ward admissions -1469

Electroencephalogram (Outpatient) -1970

Continued tele-consultation and Video consultation (for those who cannot appear physically during this pandemic situation)

Clinical activities

RMNCEC team continued its services in



Figure 57: R Madhavan Nayar Centre for Comprehensive Epilepsy Care.





Figure 58: Silver Jubilee Celebration



Figure 59: ECON 2022-23, CME



Figure 60: International Epilepsy Day



Figure 61: Epilepsy Awareness Purple Day celebration

comprehensive epilepsy care. Since 2020-2021 has been the year of the COVID-19 pandemic, additional telephone and virtual video consultation services have also been extended. The Centre continued to perform short term and long term video telemetries and indoor ward admissions for comprehensive evaluation of children and adults with complex epilepsies. The reputed epilepsy surgery services were also continued with regular post operative follow-ups. Palliative vagus nerve stimulation and ketogenic diet services were also provided. Dedicated paediatric epilepsy services are provided on all Wednesdays, including ketogenic/modified ketogenic dietary advice, genetic testing and genetic counselling for parents of children with complex epilepsies. The Kerala Registry for Epilepsy in Pregnancy (KREP) services also continued to deliver care to women with epilepsy and monitored children born to these women from a clinical and developmental perspective. The centre is also involved in training, academic activities and research projects of post-doctoral fellows in epilepsy and senior residents in neurology.

Weekly activities are as under:

- ◆ Two speciality clinics: **Wednesday** (EPI- Paediatric, general & KREP) and **Friday** (EP2- General and post op epilepsy clinics)
- ◆ Admissions to epilepsy ward for Video EEG, epilepsy care and Pre-Surgical Evaluation (daily)
- ◆ Two- Three Epilepsy Surgeries /week
- ◆ Patient management conferences- 1/week

Workshops, Conferences and other major events organized

1. Silver Jubilee Celebration of R Madhavan Nair Centre for Comprehensive Epilepsy Care from 03.08.2022 to 04.08.2022.

Inaugurated by Arif Mohammed Khan, TheHon[”]ble Governor of Kerala

2. **ECON 2022-23, CME** on “Revisiting Different Facets of Epilepsy –The way forward” from 05.08.2022 to 07.08.2022 in O’by Tamara, Trivandrum.
3. Observed International Epilepsy Day on February 13,2023
4. Celebrated Epilepsy Awareness Purple Day 29.03.2023

Title and theme of the event	Date and venue	Organizers/ Co-organizers
International Epilepsyday (Purple Day)	March 29,2023 Auditorium 2	Dr P N Sylaja Dr Easwer H V Dr Ramshekhar Menon Dr Bejoy Thomas Dr George Vilanilam Dr Ajith Cherian Dr Soumya Sundaram

Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST) celebrated 2023 Epilepsy Purple Day on March 29,2023, with a public interactive programme at Auditorium 2 of the hospital. Introduction to Purple Day was given by Dr Manju Mohan P, Speech therapist, Department of Neurology. Dr Ramshekhar N Menon, Professor

and in charge, RMNC welcomed the gathering. Dr P N Sylaja, Professor and Head, Department of Neurology gave the Presidential address. Dr Eshwar H V, Professor and Head, Department of Neuro Surgery, Dr Bejoy Thomas, Professor and Head, Department of Imaging Sciences and Interventional Radiology, Dr GeorgeVilanilam, Professor, Department of Neuro Surgery, Dr Ajith Cherian, Additional Professor, Department of Neurology, Dr Soumya Sundaram, Additional Professor, Department of Neurology felicitated the programme. Post doctoral fellows in Epilepsy Dr Harikrishnan and Dr Kiren gave awareness talks on “De-mystifying anti seizure medications and Alternative options in the management of Epilepsy”. All the participants were given brochure regarding epilepsy care. The care giver education programme was followed by cultural programmes.

Staff

Faculty

Dr Ashalatha Radhakrishnan; Professor (on leave)
Dr Ramshekhar N Menon; Professor (In-charge)
Dr Ajith Cherian, Additional Professor
Dr Mathew Abraham, Professor Neurosurgery (on leave)
Dr George C Vilanilam, Professor Neurosurgery

Technical

Mrs Sushama S R, Psychologist
Mrs Lincy Philip, Sr. Occupational Therapist
Mrs Nandini V S, Jr. Scientific Officer
Dr Manju Mohan P, Speech Therapist
Mrs Vipina V P, Speech Therapist
Mr Renjith P K, Medico Social Worker
Mrs Jayasree P, Sr. Nursing Officer



DEPARTMENT OF NEUROSURGERY

The Department of Neurosurgery is a quaternary referral centre for neurosurgical care which caters to several states of India and the department continues to serve patients in need of advanced neurosurgical treatment. The services of the department include delivery of world-class neurosurgical care, refining neurosurgical knowledge through research and innovation and providing the best academic environment for neurosurgical education. The focus of our medical and surgical services includes brain and spinal tumours, skull base surgical procedures including endoscopic surgeries, vascular surgeries including bypass surgeries for the brain surgeries for epilepsy, parkinsonism. The department trained 4 residents who were awarded the MCh Degree in Neurosurgery and 2 Postdoctoral Fellows completed their Fellowship in Cerebrovascular Surgery and Skull Base Surgery.

Clinical Activities

Patient care activities included outpatient clinics, intensive care for inpatients and operative procedures in all sub-specialties of neurosurgery, including epilepsy surgery, neuro-oncology, functional neurosurgery, skull base surgery, vascular neurosurgery, surgery of the spine and minimal access neurosurgery. The department catered to 2643 newly registered patients, and 19252 patients were reviewed in the out-patient clinic. A total of 1418 surgeries were performed during the year, encompassing various sub-specialities of neurosurgery which includes a spectrum of complex and rare procedures. State-of-art epilepsy surgery interventions for drug resistant epilepsy was done in over 120 patients as part of the R Madhavan Nair comprehensive epilepsy care centre's surgical program. The 2500th epilepsy surgery operation was done on 30th May 2023 reaching a major milestone since the inception of the program in 1995. In the field of vascular neurosurgery, innovative surgical techniques and surgeries have been described like a

unique knotting technique for deep micro-vascular anastomosis and innovation in the technique of tunneling the superficial temporal artery through the temporalis muscle.

Research Activities

The department has entered research collaborative projects with the Department of Space, Govt of India, The IIT Madras, Department of Geology, University of Kerala, Rajiv Gandhi Centre for Biotechnology etc. apart from very productive research and development collaborative efforts with the Biomedical Technology Wing of SCTIMST.

Ongoing research projects

- ◆ Creation of Gold standard Medical Imaging Datasets of Dural based lesions treated with primary gamma knife radiosurgery or micro-neurosurgery for creating artificial intelligence tools, funded by ICMR (PI: Prof George Vilanilam).
- ◆ Computational Fluid Dynamics based tools to the aid of clinical decision making in the management of intracranial aneurysms, funded by SUPRA Scheme, SERB, DST (PI: Dr B Jayanand Sudhir). Collaborating with Department of Applied Mechanics and Biomedical Engineering, IIT, Madras.
- ◆ Development of High-Performance Computing tools for Computational Fluid Dynamics-based patient specific management of Cerebral Aneurysms, funded by National Supercomputing Mission (PI: Dr B Jayanand Sudhir). Collaborating with Department of Applied Mechanics and Biomedical Engineering, IIT, Madras.



- ◆ Development of Pedicle Screw-Based Dynamic Stabilisation Systems for degenerative diseases of lumbosacral spine” funded by DST (PI: Dr Ganesh Divakar).
- ◆ Device for the efficient and effective placement of hemostatic material on the walls of surgical cavity following the excision of brain Tumors. Funded by DBT.
- ◆ Real time assessment of shift of ICA during extended endoscopic skull base surgery using intraoperative doppler and the role of tumour consistency in causing ICA displacement. Funded by ECR scheme, SERB-DST (PI: Dr Prakash Nair).
- ◆ Development of Pedicle Screw-Based Dynamic Stabilisation Systems for degenerative diseases of lumbosacral spine - funded by DST (Dr Ganesh Divakar - Clinical Principal Investigator).
- ◆ Randomised trial on utility of electrocorticography in long term, epilepsy associated tumors (LEATs) (PI: Prof George Vilanilam).
- ◆ Immunohistochemistry of long-term epilepsy associated tumors (PI: Prof George Vilanilam).
- ◆ Sulcogyral anatomy of the human cerebral cortex- In vivo analysis (PI: Prof George Vilanilam).
- ◆ Morphometry of the temporal lobe (PI: Prof George Vilanilam).

Patent filed

Multifunctional fibrous mesh sheets coated with alginate loaded with therapeutic agents as tissue extender promoting neovascularization and a process for the preparation thereof. Ref: IPTRT236.Y22 16th December, Application no. 202241072828.

Inventors: Dr B Jayanand Sudhir, Dr Sachin J Shenoy, Dr A Sabareeswaran, Dr Rakhi A, Dr Lynda V Thomas, Dr Dhanesh V, Dr Prabha D Nair.

Events Organised

- ◆ The Department of Neurosurgery, SCTIMST, Trivandrum along with its alumni, conducted a Continuing Medical Education (CME) program in honour of the late Dr R M Varma, founder Director, NIMHANS, Bangalore, India and a person who guided the Department of Neurosurgery, SCTIMST, in its fledgling years. This function was conducted as part of Azadi Ka Amrit Mahotsav events in our institution. The CME programme was inaugurated by Director, SCTIMST, Dr Sanjay Behari. The program included the conferment of the Dr R M Varma Distinguished Neurosurgical teacher award on Prof Suresh Nair, former HOD, Neurosurgery and former Dean, SCTIMST and renowned academic.
- ◆ The Prof Damodar Rout Oration as part of Chitra Neurosurgery Update organized by Chitra Neurosurgical Society was conducted on 3rd and 4th February 2023. The programme consisted of a comprehensive coverage of topics for continuing medical education and kicked off with a pre-conference workshop which consisted of various presentations on sub-specialities of neurosurgery like neuro-endoscopy, functional and epilepsy surgery, vascular and spine surgery split over 7 talks. Resources for hands on experience of spine surgery was a huge hit among the attending delegates.

Awards and Honours

- ◆ Dr Anand Binu, final year senior resident won the best paper award for the scientific paper “Role of COPEPTIN in predicting sodium homeostasis imbalances in patients undergoing pituitary adenoma surgery at the Asian Australasian association congress of neurological surgeons (AACNS) 2022 at Jerusalem.
- ◆ Dr Easwer HV has been selected as a Faculty by the National Organ and Tissue Transplant Organisation (NOTTO).



- ◆ Dr Jayanand Sudhir, Additional Professor, won the certificate of merit for outstanding performance instituted by the Institute in 2022.
- ◆ Dr Sreenath P R, senior resident won the best E-Poster for “Contralateral Suprabrow approach for a suprasellar meningioma at the Interim Skull base surgery society meeting at Kochi in April 2023.
- ◆ Dr Prakash Nair was selected for Award video presentation at the 32nd North American Skull base society meeting at Tampa, Florida in Feb 2023.

Staff

Faculty

Dr Easwer H V, Professor and Head

Dr Krishnakumar K, Professor

Dr Mathew Abraham, Professor (on leave)

Dr George Vilanilam, Professor

Dr Jayanand B Sudhir, Additional Professor

Dr Prakash Nair, Additional Professor

Dr Ganesh Divakar, Assistant Professor

Dr Tobin George, Associate Professor (Relieved on 3/10/2022)

Dr Gowtham M, Assistant Professor (Adhoc)



DEPARTMENT OF PATHOLOGY

The Department has a central role at the Institute, providing laboratory and autopsy services, participating in academic activities, and carrying out research on the diagnosis and causation of neurological and cardiovascular diseases.

Activities

Diagnostics

The Department provided surgical, cytology, immunopathology, and autopsy services pertaining to neuropathology, cardiovascular and thoracic pathology to the clinical Departments. The clinical services provided by the Department during the year 2022-23 are summarized in the Table on the right:

Research Programmes

Both extramural-funded and intramural non-funded research projects continued during the year 2022-23.

The ongoing extramural projects during the year were:

1. **In vitro modelling of temporal aging in hiPSC-derived neural cells and organoids to elucidate the molecular pathology of α -synucleinopathy**

Early detection of Parkinson's disease and other alpha-synucleinopathies is difficult due to relatively late onset with an uneventful pre-symptomatic phase until the symptoms appear at an advanced age. There is a need for an alternative model for disease progression that can be probed longitudinally to discern the molecular events during the pathogenic course. Genomic manipulation and lineage-specific differentiation of human induced pluripotent stem cells (hiPSC) into neural cells and organoids enables recapitulation of molecular and cellular aspects of disease pathogenesis in a near-physiological condition. Since aging is one of the major risk factors for alpha-synucleinopathies, inducing temporal aging in this model is worth testing.

Category	Number
Surgical samples	1484
➤ Neurosurgical biopsies	1104
➤ Cardiovascular & thoracic biopsies	380
Muscle biopsies	29
Frozen sections	710
Cytology	69
Immunohistochemistry	5581
Haematology (peripheral smears)	760
Molecular tests (FISH for 1p/19q)	7
Immunopathology	
➤ ELISA	
Anti-dsDNA	6281
Anti-phospholipid antibody	4267
Ant-neutrophil cytoplasmic antibody	697
Anti-thyroglobulin & thyroperoxidase	1406
Anti-Acetylcholine receptor antibody	1460
Anti-MUSK antibody	489
Anti-titin antibody	102
Anti-Ganglioside (IgG & IgM)	77
➤ Indirect immunofluorescence tests	24
ANA	12
AQP4-MOG	1328
VGKC	798
NMDA	249
Autoimmune encephalitis panel	47
Anti-IgLON5	58
➤ Immunoblots	116
ANA profile	60
Neuronal antigens profile	771
Ganglioside profile	502
Myositis profile	182
➤ CSF oligoclonal band assay	40
	47
	77



Transcriptome profiling of the aged brain revealed a significant protein RHBDL3, associated with aging. Hence, we aimed to overexpress this particular protein by CRISPR activation and look for phenotype and also characterize molecular phenotype (Figure 62). In order to model alpha-synucleinopathies, we generated SNCA mutation resulting in protein misfolding (Figure 63). This could faithfully recapitulate the pathological events of alpha-synucleinopathy progression.

2. DNA methylation profiling of gangliogliomas and dysembryoplastic neuroepithelial tumors

The aim of this study is to perform in-depth molecular and histopathological analysis of glioneuronal tumors in the ganglioglioma/DNET spectrum - classic ganglioglioma, classic DNET, and atypical tumors referred to as “glioneuronal tumors, Not otherwise specified”. Fifty-two cases were included in this study. Immunohistochemistry was performed on all the cases and Sanger sequencing for BRAF and FGFR1 genes were performed on 30 cases.



Figure 62: Agarose gel image of RHBDL3 sgRNA clones after PCR.

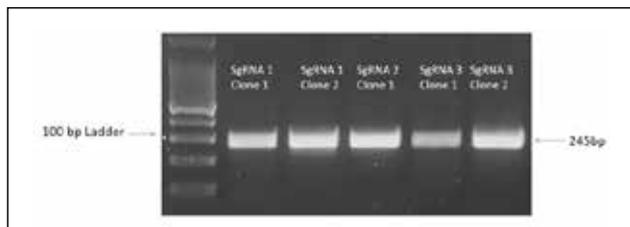


Figure 63: Agarose gel image of SNCA sgRNA clones after PCR.

2. Characterising neurodevelopmental phenotypes caused by rare loss-of-function mutations in Interferon regulatory factor 2

binding protein-like (IRF2BPL) using human induced pluripotent stem cells

Neurodevelopmental disorders (NDD) are caused by impairments in brain development and function resulting from genetic and environmental insults. A large number of genes have been identified as causal for NDDs and manifesting a diverse spectrum of phenotypes of which many are very rare. However, mechanistic studies on rare NDDs caused by genetic aberrations are limited. Recently, Interferon regulatory factor 2 binding protein-like (IRF2BPL) gene has been identified as associated with severe NDD characterized by a remarkably similar pattern of neurodevelopmental regression, abnormal movements, loss of speech, and epileptic seizures. The majority of the cases also showed brain atrophy and neuronal migration deficits. Here we aim to model IRF2BPL-deficits in hiPSC and systematically characterize the neurodevelopmental phenotypes relevant to the disease and molecular pathogenesis during cortical neuronal development. In order to study the effect of loss-of-function of IRF2BPL, we plan to knock out the gene in human iPSCs using CRISPR/Cas9-based genome editing. We have designed two guide RNAs targeting the only exon of IRF2BPL and cloned these guide RNAs into pLKO5.sgRNA.EFS.GFP plasmid. Clones obtained were confirmed by PCR (Figure 64) and Sanger sequencing (Figure 65).

4. Seven intramural non-funded, IEC-approved projects were ongoing during the year

Teaching and training

1. Interdepartmental teaching sessions (Neuropathology, Radiology-Pathology, Epilepsy-Pathology, Tumor Board): 75 sessions.
2. Neuropathology classes for DM Neurology senior residents: 30 sessions.
3. Pathology classes for MD Transfusion Medicine and Diploma in Medical Records students: 5 sessions.



- Teaching the elective course, “Biochemistry and Molecular Genetics” to PhD students as part of the PhD coursework.

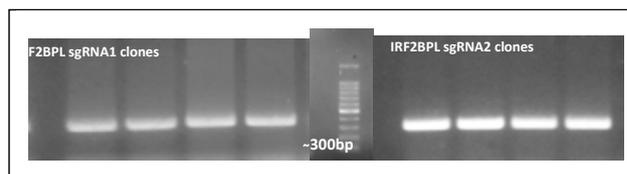


Figure 64: Representative images showing the agarose gel images after PCR of IRF2BPL sgRNA1 and sgRNA2 clones

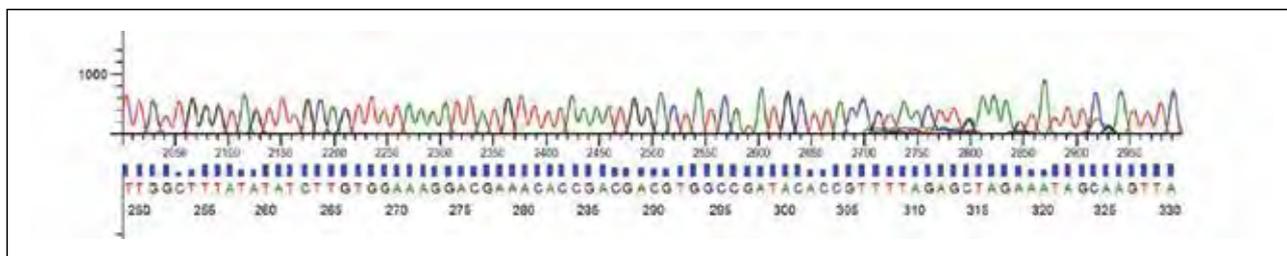


Figure 65: Representative images showing the sequence of IRF2BPL sgRNA1 clone after Sanger sequencing.

- Project work of MSc students: 5
- Internship training students: 4

Other activities

Dr Rajalakshmi P was the Chairperson of the Organizing Committee for the Swachhta Pakhwada Campaigns in May 2022 and in October 2022 at the Hospital Wing.

New Initiatives

Four new tests for patient care were introduced during the year:

- ◆ Anti-MAG and Anti-ganglioside ELISA (IgG and IgM).
- ◆ Anti-ganglioside ELISA (IgG and IgM).

Events Organized

The Department organized a talk on “Genomics and genome editing: from bench to bedside” by Dr. Binukumar, Principal Scientist, CISR-IGIB at SCTIMST on 24 March 2023.

Awards and Honours

Dr Divya M S was selected for Young Investigator’s

Meeting (YIM) held in May 2022 by India Biosciences and DBT Welcome Trust.

Dr Divya M S was selected to participate in the Women in Science and Technology conclave organized by SERB, Government of India, on 28-29 September 2022 at IIT Gandhinagar.

Staff

Faculty

Dr Deepti A N, Additional Professor & Acting Head

Dr Rajalakshmi P, Additional Professor

Dr Divya M S, Scientist C

Technical

Mr James T, Scientific Officer (Pathology)

Ms Resmi S R, Scientific Assistant (Lab)

Ms Neena Issac, Technical Assistant (Lab) - B

Ms Sheeja M, Senior Technical Assistant (Lab) (from 7 July 2022)



PAIN CLINIC

The comprehensive multidisciplinary Pain Clinic SCTIMST, is providing services as a unique & novel model since 2012. For the past 11 years since its inception, this clinic remains a noteworthy initiative undertaken within the public health care sector domain for the whole of India.

All the major patient management decisions, are based on a broad consensus taken under a single roof, facilitated collectively from faculty members under various speciality departments of the institute. The Pain Clinician Team being physically present in the same consultation room, helps at arriving at a clinical consensus fast, thus facilitating with ease all highly skilled intervention-regenerative therapeutic procedures. Following procedures as shown in (Figure 64) are routinely done.



Figure 64

1. Regenerative Prolotherapy: Platelet Rich Plasma (PRP) therapy using the patient's own blood component for regeneration in degenerative musculoskeletal conditions.
2. Radiofrequency ablation of ganglia and nerves-intracranial and spinal regions.
3. Fluoroscopy guided –Spinaldegenerative disc radiculopathies & skeletal interventions for nerve block interventions in chronic pain for non-cancer conditions.

4. Ultrasound guided therapies and nerve blocks for chronic regional pain conditions.
5. Therapeutic musculoskeletal infiltrations, facial plane infiltration, plexus infiltration interventions& trigger point injections.
6. Epidural-Regional Anaesthetic injections & Ozone Therapies.
7. Research and development initiatives for unmet clinical needs involving industrial technology transformation under make in India collaborations with Industrial Partners are also being undertaken.

New initiative

Geriatric Pain Care & Regenerative Intervention Services & OPD (GPCRIS)

This specialised Geriatric Care from the PAIN Clinic exclusively caters for the elderly patients with chronic-musculoskeletal non-cancerous pain conditions and was initiated with grant of 31.25 Lac Indian Rupees from Kusuma Trust UK (Figure 65)



Figure 65: Kusuma Trust UK

Activities

During the year 2022-23, 1006 patients were catered to the Pain Clinic (541/GPCRIS (465) OPD and Intervention suites, the details of which are provided below:



Total Registered Patients in PAIN CLINIC & GERIATRIC PAIN CLINIC (GPCRIS)	2007
Procedure & outpatient (OPD) services -	Total
Direct Referrals from outside hospitals to PAIN CLINIC	49
Direct Referrals from outside hospitals to GPCRIS	57
Review & Direct in-Hospital Referrals PAIN CLINIC	492
Review & Direct in-Hospital Referrals GPCRIS	408
Total procedure count for OPD & services catered this annum under PAIN CLINIC	579
Total procedure count for OPD & services catered this annum under GPCRIS	2683

OPD & Intervention

Major interventions are performed in the Digital Subtraction Angiography-Radiology Cath-Lab, as per the availability of the Cath-Lab and performing Interventional Pain Physicians. Minor interventions are performed in the OPD procedure room/observation room adjacent to the Cath-Lab and Room 2103, 1st floor, Middle Block.

Awards & Honours

1. Prof Rupa Sreedhar, Professor (Senior Grade), had been an invited Faculty speaker in various National conferences.
2. Dr Subin Sukesan had also been invited faculty for Tech talks, Mentorship for start-ups at IIT Kanpur, Clinical advisory and nodal faculty for industries involved with medical devices, ICMR PRIDE initiatives.



Figure 66: MOU signing with IIT-K



Patents, Technology development transfers and Research

1. The various ongoing clinical services in Pain Clinics, have led to patent-filing for unmet clinical needs, with the related technology development & transfer to Industrial partners, undertaking of MOU's, device developments and the initiation of cooperation with other institutes.
2. MOU was signed with IIT-K on 30th August 2023 to work in specific areas of collaborations, execution of goal specific plans, developing indigenous medical devices, exchange of information related to projects of mutual interest, joint submission of proposals for funding, collaborative publications & share faculty expertise with diverse modalities (Figure 66) Pain clinic will be having support for nodal coordination functioning for regenerative therapies and newer medical device technology development with industrial translation needs.

Pre-clinical research collaboration with Prof Amitabha Bandyopadhyay, Department of Biological Sciences & Bioengineering IIT Kanpur. is ongoing for Osteoarthritis Pain, regenerative autologous therapies, start-up industries, tech talks and clinical mentoring sessions for related medical device developments.

3. Orthosis development for knee and ankle support was initiated with IRC number 112/2019.
- a) TYNOR Orthotics Pvt. Ltd. sanctioned funding under "**Athmanirbhar Bharat**" initiative:
 - i) Diabetic foot ulcer offloading device for preventing plantar foot ulcers in diabetic foot.
 - ii) Rigid Valgus OA Knee brace – for patients suffering from Osteoarthritis medial or lateral uni-compartmental offloading.

DST sanctioned SEED/TIDE project for diabetic foot offloading device-Bio inspired total foot pressure off-loading device for diabetic foot ulcer management in Geriatric population.

c) SEED/TIDE 2019/534 – Rs. 51.72 Lakhs sanctioned on 29/03/2022, for the development of stance control knee ankle foot orthosis SKAFO for knee instability management.

- 4) Regenerative Prolotherapy is being addressed as a point of care affordable regenerative therapy. In Pain Clinic, same therapies were being tailored as per the patient needs, along with the physical and supportive community rehabilitation therapies. Prolotherapy's are routinely performed using the patient's own platelet rich plasma in chronic pain conditions, including osteoarthritis, rheumatoid arthritis, bursitis and chronic musculoskeletal pain conditions. This was a first in its kind of collaboration seen with the Department of Transfusion Medicine, in India for initiating autologous therapy (patient's own blood component-platelets) for degenerative joint and musculoskeletal chronic non-cancerous pain conditions.

Staff

Faculty

Dr Subin Sukesan, Incharge & PI Geriatric Pain (GPCRIS) and Pain Clinic.

Dr Srinivas VG, Pain clinic project PI

Dr Rupa Sreedhar, Founder

Dr Easwer H V, Professor & Head Neurosurgery.

Dr Santosh K, Professor, IS & IR

Dr Jijo Varghese, Assistant Professor (Adhoc) Physical Medicine & Rehabilitation.

Dr PK Dash, Professor

Dr Suneel P R, Professor

Dr Saravanababu M S

Dr Jayadevan ER, Professor, IS & IR

Dr Jineesh V, Associate Professor, IS & IR

Dr Debashish Gupta, Professor & Head, Transfusion Medicine

Dr Vinu R, Assistant Professor (Adhoc), Transfusion Medicine

Dr Biju Soman, Professor, AMCHSS



DEPARTMENT OF TRANSFUSION MEDICINE

The Department of Transfusion Medicine provides round-the-clock services for blood and blood components to the institute, conducts research activities and trains physicians and technicians.

Activities

Clinical Activities

About 9605 blood donors were registered for blood donation from April 2022-March 2023. Out of these 9605 donors, 6061 blood donors were found eligible to donate blood. Additionally, 107 outdoor blood donation camps were organized during the year, which collected 3138 blood units. Only 48 (0.8%) units were discarded for various reasons. Out of 6061 units collected, our division prepared 5958 red blood cells, 5955 units of Plasma, 1829 units of Platelets and 1552 units of cryoprecipitate. Additionally, 16 units of Single Donor Platelets were collected through apheresis. The department carried out 25987 Blood Grouping procedures, 9357 units of blood were cross-matched and 22473 patients and donors were tested for irregular antibodies.

Research activities/technologies developed

In total 88 units of Autologous blood were transfused for surgical patients. Additionally, 521 units of Platelet Rich Plasma therapy were used in treating Musculoskeletal disorders. The department also obtained the license for Apheresis to collect peripheral stem cells, red cells and granulocytes.

Events Organized

1. WORLD BLOOD DONOR DAY on 14th June 2022 by organizing a Slogan, Quiz, Essay and Short Story writing competition based on Voluntary Blood Donation and Transfusion Medicine for various categories of staff.
2. NATIONAL VOLUNTARY BLOOD DONATION DAY on 1st October 2022 to felicitate Blood Donation Camp Organizers,

Regular Voluntary Blood Donors and Blood Donor Motivators.

3. Workshop on Laboratory Quality Control in Transfusion Medicine in August 2022 for Blood Centre Doctors and Technicians of Kerala.
4. Kerala State-level refresher training for Blood Centre Counsellors in February 2023
5. Workshop on Immunohematology Techniques on February 2023 participated by Blood Centre Doctors and Technicians of Kerala.

Awards, citations and honours

1. Dr Debasish Gupta received the Lifetime Achievement Award from the Indian Society of Blood Transfusion Immunohematology.
2. Dr Debasish Gupta received the ISBTI Oration Award from the Indian Society of Blood Transfusion Immunohematology.
3. Dr Debasish Gupta received the Third Prize from Nagar Rajbhasa Karanyavyan Samiti as an Editor for the Annual SCTIMST Hindi Magazine "Chitralekha".
4. Dr Amita R received J.G. Jolly Award for the year 2021 from the Indian Society of Immunohematology and Blood Transfusion.
5. Dr Amita R received USA President's Award in November 2022 from AABB (Association for Advancement of Blood and Biotherapies)
6. Dr Amita R received the SCTIMST Certificate of Excellence Award 2022 (Associate Professor Category).
7. Dr Amita R received KEBS- RUDHRA Blood Donation Award 2022 for promoting voluntary blood donation-related activities.



8. Dr Vinu Rajendran received J G Jolly Award for academic and research excellence during the ISBTI National Conference (Transcon 22 B) conducted at Jammu, in November 2022.
9. Dr Vinu Rajendran received second position for poster presentation during the ISBTI National Conference (Transcon 22 B) conducted at Jammu, in November 2022.
10. Dr Angel Mary Sam received J G Jolly Award for the best postgraduate research, during ISTM National Conference, TRANSMEDCON 2022.
11. Dr Shivanand won 1st prize in the post-graduate quiz competition team event in CME “Multidimensional approaches in transfusion medicine” in January 2023.
12. Dr Shivanand won 1st prize for a free paper presentation titled, “Is the type and crossmatch required for endoscopic excision of pituitary adenoma?” in CME “Multidimensional approaches in transfusion medicine” in January 2023.
13. Dr Punkesh Patel won 1st prize for the free paper presentation titled, “Predictors of Massive Blood Transfusion in Coronary Artery Bypass Graft Surgery in a tertiary care hospital-based Blood Centre” in 29th ISBTI Kerala Chapter meeting in December 2022.
14. Dr Punkesh Patel won 1st prize in the post-graduate quiz competition team event in CME “Multidimensional approaches in transfusion medicine” in January 2023.
15. Ms Sindhu M S Received ISBTI Technologist Fellowship Award at the ISBTI National Conference (Transcon 22 B) conducted at Jammu, in November 2022.
16. Dr Debasish Gupta has been elected as the National President of the Indian Society of Transfusion Medicine (ISTM) for a period of 3 years.
17. Dr Debasish Gupta is elected as the Executive Member of the Hemovigilance Program of India under the National Institute of Biologicals, Ministry of Health and Family Welfare, Government of India.
18. Dr Debasish Gupta is nominated as the Executive Member of the Expert Working Group for Blood and Blood-Related Products under the Indian Pharmacopoeia Commission, Ministry of Health and Family Welfare, Government of India.
19. Dr Debasish Gupta is nominated as a member of the Expert Group of Establishment of Capital Blood Banks in India under the Health and Family Welfare Division, NITI AAYOG, Government of India.
20. Dr Debasish Gupta is empaneled as an Examiner with the National Board of Examinations in Medical Sciences for the DNB examination of Immunohematology and Blood Transfusion.

Staff

Faculty

Dr Debasish Gupta, Professor and Head

Dr R Amita, Associate Professor

Dr Vinu Rajendran, Assistant Professor (Ad Hoc)

Technical

Ms Sindhu P N, Scientific Officer

Ms Baby Saritha G., Junior Scientific Officer

Mr Sivakumar S, Senior Technical Assistant

Ms Jyothi M, Senior Technical Assistant

Mr Sunil K P, Technical Assistant B

Ms Sindhu M S, Technical Assistant B

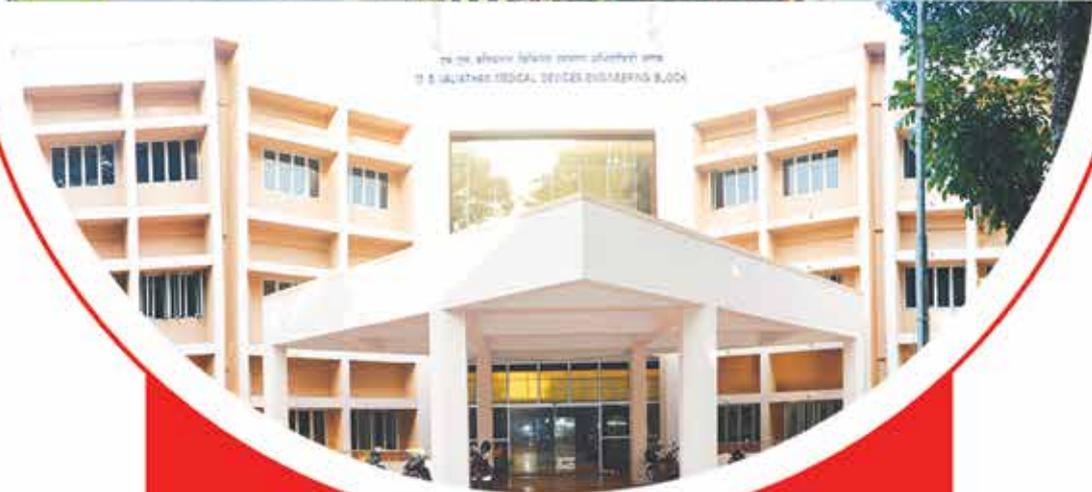
Ms Renjini P, Technical Assistant B

Ms Manju K Nair, Technical Assistant B

Ms Preethy Prakash, Technical Assistant B

Mr George Paul Thaliyath, Medical Social Worker





BIOMEDICAL TECHNOLOGY WING

DEPARTMENT OF APPLIED BIOLOGY

Department of Applied Biology plays a crucial role in the development of medical devices by providing medical device evaluation in accordance with international standards like ISO 10993 for biocompatibility, ASTM standards, OECD guidelines, and United States Pharmacopeia (USP). Numerous tests carried out by the Department are approved by COFRAC of France and are on the quality platform as per ISO 17025. External clients, including Indian and foreign medical device manufacturers, can also access these tests. The Department's Divisions also have a strong research foundation, which gave rise to a number of technologies. The Department is engaged in cutting-edge research projects in fields such as 3D bioprinting, regenerative technologies, stem cell therapy, memory and learning, sleep, material-cell microbiological interactions, biomaterial-tissue interactions, and laboratory animal studies.

The Department of Applied Biology comprises the Divisions of: (i) Experimental Pathology, (ii) Laboratory Animal Science, (iii) Microbial Technology, (iv) Molecular Medicine, (v) Sleep Research, (vi) Tissue Culture, (vii) Tissue Engineering and Regenerative Technologies, (viii) Thrombosis Research, (ix) Toxicology and (x) In-Vivo Models and Testing.

DIVISION OF EXPERIMENTAL PATHOLOGY

The division focuses mainly on (1) Development of biomedical device and evaluation of biomaterials; (2) Consultancy services to internal and external researchers on all aspects of animal experimentation focusing experimental pathology and (3) Disease/health monitoring in laboratory animals.

Histopathology laboratory is unique in the country as a COFRAC accredited laboratory having facilities to undertake routine as well as a wide range of specialized techniques for evaluation of biocompatibility of various biomaterials as per international standards and pre-

clinical evaluation of medical devices as per approved protocols. The laboratory is a notified medical device testing laboratory approved by CDSCO for evaluation of biocompatibility for medical devices under the medical devices rules, 2017, GoI.

Developmental Activities

- Evaluation of the potential of cholecyst extracellular matrix scaffold (CECM) scaffold for cardiac application and for diabetic wound healing.
- Preparation of various formulations of cholecyst scaffold like powder, gel etc and evaluation of the potential for various applications.
- Preparation of hybrid products for hernia repair.

New initiatives

- Preparation and characterisation of an injectable gel formulation of porcine cholecystic extracellular matrix.

Technology transfer activities

The Division developed an innovative non-detergent/enzymatic method for preparing biomaterial grade porcine cholecyst (gall bladder) extracellular matrix scaffold (CECM). It promotes faster healing of skin-wounds with minimal scarring compared to similar scaffolds available in international market. Prototype of biomedical device for graft assisted healing of skin wound was prepared and named as Cholederm.

This technology has been transferred to M/s Alicorn Medical Pvt. Ltd which later became an incubatee in TiMed of SCTIMST. The product is named as Cholederm™ and registered with the Central Drugs Standard Control Organisation (CDSCO) as a class D biomedical device. M/s Alicorn has got the statutory approval of the CDSCO for test manufacturing. Validation of the manufacturing procedures and



pre-clinical safety evaluation are progressing. The Company has submitted the application to CDSCO for the final drug licence for Cholederm™.

Testing and evaluation

1. In the Histopathology Laboratory, a total number of 216 tissue specimens were received which includes muscle, subcutaneous tissue, bone with implant for biocompatibility evaluation as per ISO 10993-6. Preclinical evaluation specimens such as bioprosthetic heart valve, mitral annuloplasty ring, aortic patch, coronary stents, wound healing products, degradable Magnesium, Zinc alloy bone plates, dental implants, scaffolds seeded with cells using 3D bioprinting technique and acute respiratory distress syndrome lung specimens were also received.
2. Consultancy service was offered to Kerala Veterinary and Animal Science University for the study “Histomorphological evaluation of pulmonary tuberculosis in Asian elephants”.
3. In the year 2022, 35 test reports were issued from the laboratory which included 12 accredited, 21 non-accredited and 2 necropsy reports. COFRAC surveillance assessment has been completed successfully during January 2023. Laboratory has maintained quality system for the past 20 years and retained COFRAC Accreditation successfully for intramuscular, subcutaneous and bone implantation tests and mucosal irritation tests.
4. Safety evaluation of liquid embolic agent was carried out in pig animal model following standard procedure rete-mirabile cerebri vessels embolization. Post 3- and 6-months experimental period, animals were sacrificed humanely and rete-mirabile with polymer cast was harvested and subjected to histopathological evaluation. Gross and Histopathology evaluation revealed healing response and fibrosis of blood vessels and polymer cast observed in the lumen.
5. Decellularised bovine pericardium bioprosthesis in mitral valve replacement. Sheep animal model was used. Post 6 months experimental period,

animals were sacrificed humanely and healing tissue response was evaluated which included thromboembolic complication, calcification, structural integrity of leaflets.

6. C-band polymer annuloplasty ring in sheep model in TDF programme. Sheep animal model was used. Post 6 months experimental period, animals were sacrificed humanely and annulus healing tissue response was evaluated which included thromboembolic complication, calcification, structural integrity of leaflets.
7. Gross and histopathological evaluation of sheep femur bone with Mg alloy and Zn alloy plates and metal screw implant to study the local tissue response and implant degradation and integration with the newly formed bone was carried out.

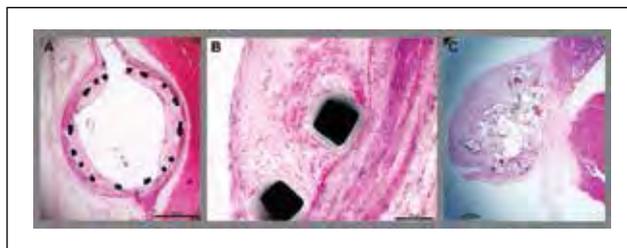


Figure 1: A: Histology-Cross section of Pig Coronary blood vessel with metal stent in lumen and a branching vessel (H&E stain, 1 X magnification); B: Histology- Pig coronary vessel with metal stent strut and neointima (H&E stain, 20 X magnification); C: Histology of mitral annulus with annuloplasty ring fabric and tissue ingrowth.

Training/outreach programs

- Under the SC/ST empowerment programme 5 graduate students and 8 plus two students were trained in routine light microscopy and special staining techniques using tissue sections.

Other significant achievements:

- Dr TV Anilkumar has been elected as a Fellow of the National Academy of Agricultural Sciences (NAAS).
- Dr TV Anilkumar has been elected as President of Laboratory Animal Veterinarian’s Association.



- PhD student Manjula PM received the “Best paper publication award – 2022” from the Institute at the 38th annual convocation for the paper: Manjula PM, Sachin J. Shenoy, Reshmi Raj, Geetha, CS, Pratheesh KV, Reshma S, Purnima C, and Anilkumar TV. (2021). Gelatin-Modified Cholecyst-Derived Scaffold Promotes Angiogenesis and Faster Healing of Diabetic Wounds. *ACS Applied Bio Materials*, 4 (4), 3320-3331. DOI: 10.1021/acsabm.0c01648.
- Ms Manjula PM and Ms Reshmi Raj received their PhD degrees from the Institute in the 38th Annual Convocation.

DIVISION OF LABORATORY ANIMAL SCIENCE

The mission of the DLAS is to adhere to statutory requirements, to maintain CCSEA registration of the facility and the care and welfare protocols, to upkeep quality maintenance standards in the animal production, management and care, meeting demands of animal supply in terms with ISO 10993 Part-2 requirements. Basic mandate is to provide good quality laboratory animals for in-house research and development of small animal models in a time-bound fashion, maintenance of Committee for the Control and Supervision of Experiments on Animals (CCSEA) registration by complying to the statutory requirements and guidelines, providing technical and research support to investigators to develop animal models for their proof-of-concept studies and providing animals as well as adequate veterinary care to animals supplied for testing purposes. It is the function of the division to provide training to the budding researchers, veterinarians, PhD students and scientists, and to support various academic programs of the Institute. The mission of the Division is to bring in the periodically upgraded techniques and data to refine animal management and the benefit of animal welfare.

Developmental Activities

- Enhancing insulin production of islet like clusters derived from mesenchymal stem cells by transfecting specific microRNAs. Rat diabetic model was developed and the study got completed during this year.
- Study of efficacy evaluation of alginate based wound care biomaterial for diabetic wound management. Rabbit model was developed and the study got completed during this year.

Research programs

- An external study on “Biocompatible and injectable hydrogel for prevention of post-surgical adhesions” from Envisage MedTech, Kolkata was accepted. B Form sanction obtained from IAEC.
- Study on “Adipose tissue derived stromal vascular fraction in neural tissue engineering - in vivo study on rat spinal cord injury model”. Sree Anjaneya Institute for Dental Sciences, Calicut. B Form sanction obtained from IAEC.

Testing and evaluation

- Inauguration of the upgraded small animal facility has been done on 14th November 2022 by Dr. OP Chaudhary, Joint Secretary of National Livestock Mission and Secretary of Animal Welfare Board and CPCSEA.

Animals supply

- Animals supplied for in-house research and testing:
Rabbits- New Zealand white-152, Rats (Wistar and Sprague Dawley)- 305, Mice (BALB/c, Swiss Albino and C57Bl/6J) – 255, Guinea pigs (Dunkin Hartley) – 195.
- Supplied (sale) to CCSEA registered external users:
Rabbits- New Zealand white-8, Rats (Wistar and Sprague Dawley)- 689, Mice (BALB/c, Swiss Albino and C57Bl/6J) – 534.

Training/outreach programs

- Dr Harikrishnan VS was (i) Invited to chair a session in “SAAE-INDIA 2022-Conference on Alternatives to Animal Experiments in



Translational Research” at Kerala University, Kariavattom Campus during 8-9 December 2022; (ii) Attended CPCSEA meeting on 30.05.2022 in New Delhi as a member/Nominee of CPCSEA; (iii) Presented a paper on “Refinement of the rat contusion model of thoracic spinal cord injury” in FELASA congress held at Marseilles, France during 13-16 June 2022; (iv) Visited the Research Lab in Neurological Mice Models for Traumatic Brain Injury at Biomedical Center (BMC, Lund, Sweden) at University of Copenhagen, Denmark from 19 Sept to 26 Oct 22; (v) Completed a course in Swedish Legislation, Ethics, Animal Welfare and 3R's on 23.09.2022 including Ethics and Animal Use, Swedish Legislation, 2010/63/EU, Animal Records, Identification Methods, Humane Endpoints; and (vi) Attended the 107th meeting of CCSEA held on 28.02.2023.

- Conducted a two-day conference - DEW 2022 - “Defining Ethics and Welfare in Preclinical Research and Workshop on Preparing B forms and the Conduct of IAEC” during 14-15 November in AMC Auditorium, SCTIMST. 150 participants attended the event.

Significant achievements

Poster Award- “Ensuring the welfare of C57BL/6# mice model that unravel therapeutic effects of stem cell derived exosomes in management of acute lung injury” by Anand Krishnan, Harikrishnan VS, Sabareeswaran A, Naresh Kasoju, in two-day conference DEW 2022, “Defining Ethics and Welfare in Preclinical Research” 14-15 November 2022, in SCTIMST, Trivandrum.

DIVISION OF MICROBIAL TECHNOLOGY

The Division of Microbial Technology activities come under three sections: (1) Testing services; (2) Research; (3) Academics. In supporting medical device development, the Division functions on a quality platform and is ISO 17025 accredited by Le Comité Français d'accréditation (COFRAC), France. The Division offers a number of tests based on international standards to the researchers within as well as outside the institute. We also perform health monitoring of experimental animals both small and

large animals, to ensure high-quality animals for experimental purposes, biocompatibility assessments and pre-clinical studies. The research in the Division focuses on material-cell-microbial interactions and immune modulations, Medical device-related infections, Microbial biofilms and their molecular biology, Development of Rapid diagnostic devices for microbial infections. In the realm of Academics, the faculty of the division mentors PhD, MSc, MDS students and participates in training programs for Industry.

Developmental Activities

1. Microbiological evaluations -TRC project.
2. ICMR validation of Rapidogram a rapid diagnostic kit for UTI.

New initiatives

- Studies on nanomaterial -microbial interactions have been initiated. The focus is on how nanomaterials impact bacterial; life and metabolism and in case of fluorescing nanomaterials the additional effect of life cycle stage and pH on properties of nanomaterials.
- Received DBT-SAHAJ Infrastructure project titled “National Translational Research Facility for Biomaterials, Medical Devices and In vitro Diagnostics (IVDs)” for a period of 5 years at a total cost of Rs.9,52,423,20. This major project has been initiated.

Technology Transfer activities

- ICMR validation of Rapidogram a rapid diagnostic kit for UTI is progressing. The technology has been transferred to M/s Agappe diagnostics.

Research programmes

Cell-material-microbial interactions - Effect of Pseudomonas biofilms on A549 cells: Studying the epithelial responses helps to understand the immediate or primary innate immune response to invading pathogens. Neutrophil responses involving the immune system are the second line of defence against pathogens like Pseudomonas. The mechanism



of cell death induced by planktonic *Pseudomonas* was observed to be necrosis. Biofilm bacteria were less internalized than planktonic bacteria. Thus phagocytosis one of the major antibacterial mechanisms, was prevented by biofilms. Whereas A549 cells exposed to biofilms showed features of both apoptosis and necrosis. Cellular blebbing and nuclear fragmentation were the key apoptotic features observed in A549 cells exposed to biofilms. Few cells also showed necrotic changes like loss of membrane integrity and cellular swelling. Biofilms induced an up-regulation of TNF α alone and IL8, IL6, and IL1 β . The nuclear changes revealed the presence of fragmented nuclei within an intact nuclear membrane, which was atypical of both apoptosis and necrosis and is indicative of a pyroptotic mechanism of cell death.

Inflammasome-mediated activation of caspase 1 leading to the upregulation of IL1 β is the key identification feature of pyroptotic cell death. Upon evaluation, both Caspase 1 and IL1 β were upregulated in A549 cells infected with a biofilm of both ATCC27853 and Clinical isolates. Caspase 3, the executioner caspase in apoptosis, and Pi3K, an inflammasome inhibitor, were expressed only at a basal level.

Electrical cell surface impedance sensing (ECIS) as a tool to study microbial-cell interactions: The study of bacterial-cell interactions to delineate intricate mechanisms involved in pathogenicity is often hampered by the lack of suitable non-destructive methods, which are label-free and in real-time. Our data suggest that contrary to endpoint analysis ECIS provides a unique platform for understanding cellular interactions, cell-material, and microbial-cell interactions, which are discrete, nuanced, and multiparametric. ECIS helps understand early changes in the cell-cellular morphology, cytoskeletal changes, and intracellular junctional changes, which are usually forerunners of endpoint observations. We could observe marked differences in the impedance patterns using different multiplicity of infections and different frequencies and record the changes over time. It can also be observed that, during the infection process, *Pseudomonas* disrupts the barrier integrity during the early phase of infection, as early as 2hr PI

and a reduction of barrier integrity, facilitates bacterial invasion of the epithelium, increasing its susceptibility to infection.

Azithromycin pre-treatment helped preserve barrier integrity and changes due to infection with *Pseudomonas* were delayed. The ability of Azithromycin to improve barrier properties of broncho-epithelial cells was described by Holldorsson et al. We observed that pre-treatment of 40 μ g/ml azithromycin significantly delayed infection by the clinical isolate S373 and inhibited the progression of infection by ATCC 27853. This could be due to the upregulation in the tight junctional protein expression by A549 cells or the prevention of degradation of these TJ proteins due to azithromycin treatment.

Our study suggests the feasibility of the use of ECIS to study the changes in barrier integrity due to any stimuli. ECIS specifically measures nanoscale morphological changes in challenged adherent cell monolayers and thus is a more sensitive tool than the assessment of morphology by light microscopy or by fixing and staining infected cells, or doing endpoint analysis. But the major limitation of the ECIS technique is that it is applicable only to adherent monolayers and does not provide direct information on molecular-level changes, an endpoint assay.

Carbon black nanoparticles (CBNP) and its role in pulmonary fibrosis: Idiopathic pulmonary fibrosis comes under the large umbrella of interstitial lung diseases; resulting in scarring (fibrosis) of the lungs for an unknown reason. Over time, the scarring worsens, it becomes hard to take in a deep breath, and the lungs cannot take in enough oxygen. The deposition of nanoparticles (less than 100 nm size) in the lung can lead to chronic inflammation, epithelial injury, fibroblast activation, and pulmonary fibrosis. Carbon black nanoparticle one of the top 50 most produced chemicals around the world was selected for the study and at the first level the immunological responses understood using monocyte cultures.

The 24h exposure to high concentrations of CBNP induced cell enlargement and loss of morphology in monocytes. Phase contrast microscopy of CBNP-exposed THP1 cells showed that the size of cells was



increased up to 3-fold, and a marked reduction in viability was also observed.

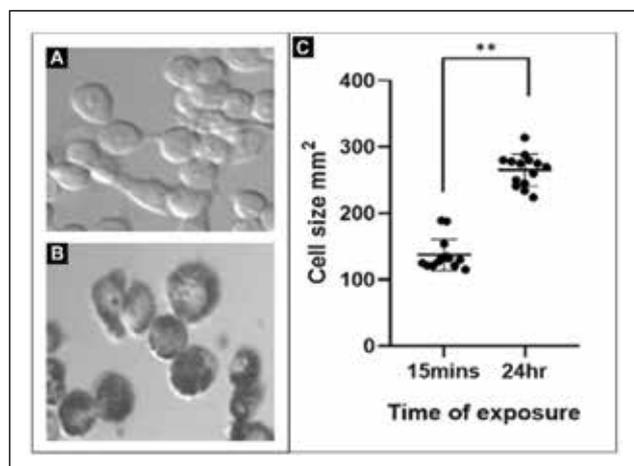


Figure 2: Analysis of change in size of THP1 cells after short-term CBNP exposure. The control cells (shown in Pic A), on exposing to 80 µg/ml CBNP shows expansion (Pic B). Pic C shows cell size measurements after 15 min and 24h

Testing and evaluation

The Division has established and maintains a class 10,000 clean room facility for the performance of sterility test, a full-fledged Microbiology laboratory following good Microbiological Practices (GMP) for the performance of accredited tests like Bioburden analysis on Medical devices and biomaterials and in vitro genotoxicity assay, the Ames test and non-accredited tests like antimicrobial activity evaluations, evaluating disinfecting devices in study mode, Microbiological monitoring of air and water etc. As the division functions on the quality platform, all activities are in compliance with ISO 17025 in general, and following individual standards for the respective tests. During this period, the Division reviewed and revised ten documents and had undergone two internal audits and one external audit by COFRAC of France.

Tests performed: A total 159 samples were tested in 55 work orders, during the period. The tests, number of number of requests (with the number of samples) are given as below.

Accredited tests: (i) Sterility Test – 6 (6); (ii) Bioburden Analysis – 1 (1).

Non-accredited tests: (iii) Microbiological monitoring of controlled environment - 22(53); (iv) Microbiological analysis of water 18 (41); (v) Spore Viability Test based on USP-3 (3); (vi) Anti-microbial activity testing- Agar diffusion method -2 (6); (vii) Bacterial Adhesion studies – 2 (14); (viii) Culture/Staining - 1 (1); and (ix) Growth Promotion Study in Media Validation - 7 (41);

Study requests: (i) Microbiological evaluation of three formulations of Industrial significance; (ii) Microbiological evaluation Tenshield Air Ioniser; and (iii) Antifungal study of drug-loaded softeners using *C.albicans* (internal).

Training/outreach programs

1. Dr A Maya Nandkumar served as resource person Sree Ayyappa College for Women, Nagercoil for a session on Career Guidance for Biology students on 13.5.2023.
2. Dr A Maya Nandkumar mentored a student as part of Empowerment program for SC/ST students- DST -SCTIMST summer scholarship 2022 -third batch
3. Final defence of PhD student Ms Keerthi S was conducted and degree awarded. Title of thesis: “Immune modulations in *Pseudomonas aeruginosa* biofilms”.

DIVISION OF MOLECULAR MEDICINE

The Division primarily concentrates on two key areas. Firstly, we focus on developing indigenous diagnostic kits for infectious diseases such as pulmonary tuberculosis, HPV16/18 for early detection of cervical cancer, and Covid-19 (SARS CoV2). We have successfully developed and commercialized these kits. Secondly, we focus on exploring the fundamental aspects of neurobiology, particularly in deciphering the molecular pathways involved in information storage within neurons. To achieve this, we utilize the simplicity of *C. elegans*, a nematode species, as our model organism for research.



Developmental activities

Development of detection kits for infectious diseases:

- (a) SARS CoV2: During the Covid19 pandemic, we developed and commercialized RNA isolation kits and real-time RT-PCR kits for SARS CoV2. Both of these kits are commercially successful and aid in disease detection. WHO is making a significant effort to incorporate these technologies into their Covid19 Technology Pool (C-TAP) initiative. A Memorandum of Understanding in this regard is awaiting approval from the Government of India.
- (b) Pulmonary tuberculosis: For the last few years, we have been working on the development of a diagnostic kit for the detection of Mycobacterium tuberculosis, the causative agent of pulmonary tuberculosis (TB). The current gold standard for accurate detection is the real-time PCR method. However, we have been working on an alternative and more cost-effective technique – the Real-time Loop-mediated Isothermal Amplification (LAMP).

The LAMP-based method offers high specificity due to the utilization of six primers that recognize the target sequence. Furthermore, this amplification technique can be performed at a constant temperature of 60°C, thus negating the necessity for a thermal cycler. Additionally, it is less impacted by inhibitors commonly encountered in biological samples.

Our team has successfully standardized this technique by targeting the mpt64 gene. The clinical validation phase of our study has been completed, and the technology has been transferred to M/S Agappe Diagnostics for commercialization.

- (c) Human papilloma virus – HPV16/18 detection: Detection of Human papillomavirus HPV 16/18 DNA and E6/E7 mRNA as an early marker for cervical cancer. We have developed a real-time multiplex LAMP-based amplification of HPV E6/E7 mRNA and HPV 16/18 DNA as a highly sensitive test for the detection of early stages of

cervical cancer. The detection time is less than 30 minutes. The programme is at the stage of clinical validation.

Our team has successfully developed a real-time, multiplex LAMP-based amplification method that targets both Human Papillomavirus (HPV) E6/E7 mRNA and HPV 16/18 DNA. This novel approach aims to serve as a highly sensitive test for identifying the initial stages of cervical cancer. One significant advantage of our technique is the reduced detection time of less than 30 minutes, which offers great potential for efficient screening processes. Currently, the technology is in the process of commercial transfer.

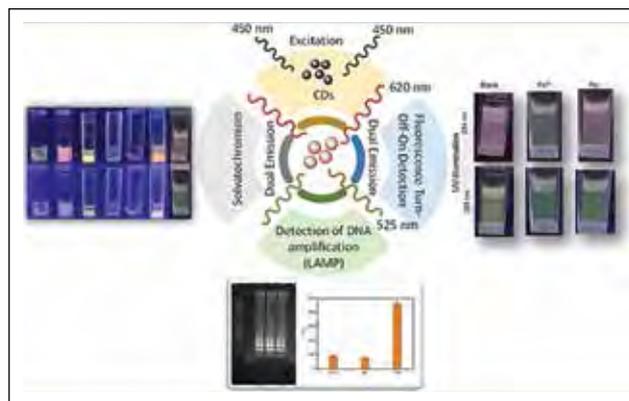


Figure 3. Fluorometric detection of pyrophosphate (PPi) to confirm the loop-mediated isothermal amplification (LAMP) reaction

New initiatives

Dual-Emissive Carbon Dot for Fluorometric Detection of the Loop-Mediated Isothermal Amplification Reaction: Carbon dots (CD) have gained widespread recognition for their capability to detect biologically relevant ions, sugars, and proteins in cellular environments through fluorescence turn-on or turn-off mechanisms. To date, most CD probes have primarily been used for concurrent detection of Fe³⁺ and PPi in aqueous solutions, environmental samples, and intracellular sensing applications.

It is well-established that PPi plays a crucial role in adenosine triphosphate disodium salt (ATP)

hydrolysis and serves as a primary byproduct during DNA and RNA polymerization as well as other fundamental physiological processes. For instance, during polymerase chain reaction (PCR) or loop-mediated isothermal amplification (LAMP) procedures, PPI is released when deoxynucleotide triphosphates (dNTPs) are incorporated into DNA strands. Consequently, sensitive detection of PPI generated during PCR or LAMP reactions can be employed as an indirect method for visualizing the polymerization process. We have conducted a study to ascertain the potential practical application of the CD probe in detecting *Mycobacterium tuberculosis*. Our research involved carrying out the fluorometric detection of pyrophosphate (PPI) to confirm the loop-mediated isothermal amplification (LAMP) reaction.

Technology Transfer activities:

Real time LAMP assays kit for the detection of *Mycobacterium tuberculosis* to Agappe Diagnostics, Kochi.

Research programs

Regulation of neuronal function during learning and memory: Animals receive a variety of external stimuli to perceive information about their environment, which causes essential behavioral changes and short-lived neuronal alterations. It appears to be mediated by monoamines and a precursor tyramine (TA), is important in the Risk-Reward pathway and may act as a neurotransmitter. However, the molecular mechanisms underlying the tyramine pathway remain unknown, as does their role in memory formation. In *C. elegans*, tyramine secretion is limited to the interneuron RIM, which is the master motor neuron; these characteristics make the model suitable for testing the role of monoamines in the olfactory adaptive learning and memory paradigm.

Our findings suggest that the fast-acting tyramine receptor LGC-55 in the organism's head neurons plays an important role, which could be aided by the second tyramine receptor SER-2 in the mid-body, facilitating the initiation of the escape cascade. This event may also provide the organism with a stronger memory of potential threats in the near future, allowing it to adapt

to its immediate surroundings. Tyramine regulates this top-down approach to multisensory decision-making in worms, and it plays an important role in behavioral changes based on learning and memory.

Dopamine is a critical neurotransmitter that has been shown to modulate neuronal function. Another popular theory holds that dopamine influences reinforcement learning. According to the findings of the current study, insulin can also function as a reward signal during associative learning. Dopamine signaling was also discovered to work downstream of insulin signaling. Our research is attempting to determine the effect of insulin, dopamine and their relationship in the context of learning and memory.

DIVISION OF SLEEP RESEARCH

In this division, research is aimed to explore the hidden mysteries of sleep and to identify non-pharmacological measures to improve sleep quality which is fundamental to human health and wellbeing. The sleep research laboratory is equipped with latest instruments to study the role of sleep-in developmental programming including ontogenetic organization of sleep-wakefulness, autonomic nervous system and circadian rhythms (melatonin) for an optimal cognitive development using rodent insomnia model. Research outputs from this division are published in International Journals and are presented in various National and International Conferences. The Division of Sleep Research provides extensive training of techniques involved in sleep and regularly conducts sleep awareness programs.

Research programs

Effects of sleep loss during late pregnancy in rats were evaluated in offspring immediately after birth until adolescence, taking various parameters including the state dependent heart rate variability and chronodisruption of melatonin hormone in relation with cognitive development. Sleep and heart rate were assessed using electrophysiological parameters by recording electrical activity of brain (EEG) and neck muscle activity (EMG) and heart rate (ECG) in free moving animals. These signals are analyzed offline for depicting changes in state dependent heart rate



variability. Sleep deprivation during pregnancy not only activated the sympathetic outflow but also suppressed development of parasympathetic component of the autonomic system in pups. These studies provided evidences for alteration in brain and heart regulatory mechanisms during early development indicating that both are vulnerable to early life stress. The postnatal development of brain network is a complex process and requires time dependent fine tuning for achieving an age matched appropriate emotional and cognitive behaviour in children.

Human study showed promising role of YogaNidra in management of sleep quality and overall wellbeing in aging woman. The pilot study carried out in a postmenopausal subject with insomnia showed that practice of YogaNidra in morning and 25 -30 minutes of walking in evening significantly improved her sleep quality and overall wellbeing. Sleep and activity rhythms were monitored continuously using actigraphy (Somnomedics Plus) for 28 weeks (4 weeks of pre-intervention control and 24 weeks of Yoga Nidra intervention) and along with the sleep diary. YogaNidra and walking dual protocol is proposed as an efficient therapeutic tool to contain insomnia and to improve overall wellbeing in postmenopausal age.

Testing and evaluation

Test study titled 'Study of hypnotic property of the herbal extract in sleep deprived rats' was carried out that was sponsored by Natural Remedies Pvt. Ltd., Bangalore.

Training/outreach programs

- Dr K Gulia convened a symposium titled Sleep Health, a crucial concern in the current era in the 68th APPICON meeting held in PGIMER Chandigarh on 13 Dec 2022 and delivered a talk titled Brainstorming on perinatal sleep and outcomes in children.
- Dr K Gulia delivered two sleep awareness talks on 8th Dec 2022 as a part of the Azadi ka Amrit Mahotsav celebrations
- World Sleep Day 2023 was celebrated on 17 March 2023 to bring awareness about sleep in general and scientific community.

DIVISION OF TISSUE CULTURE

The Division of Tissue Culture is involved in tissue-based research and development activities and provides testing support for product development. The division also participates in academic programs of the Institute to generate trained human resource specifically in cell culture and tissue engineering through academic trainings and research projects. The Division offers in vitro cytotoxicity testing as per the ISO/IEC 17025 quality platform to internal and external customers. The tests are accredited by Le Comité français d'accréditation (COFRAC), France. The division also extends a range of in vitro tests to customers as per the specific requirement such as cell-material interactions, image analysis and cell-based assays. The research activities include cell-material interaction, stem cells, scaffolds for tissue engineering, 3D Bioprinting and in vitro tissue models. Two major focus of the Division is biofabrication of liver construct and corneal epithelial cell sheet engineering. Various other ongoing research programs are development of three dimensional (3D) bioprinted hepatotoxicity test system, efficacy evaluation of cell sheet technology for translation, studying role of Hsp 70 in myoblast differentiation and bioengineered construct for myocardial repair.

The Division also maintains the 3D Bioprinting and Biofabrication Facility of the institute that is equipped with multi-technology 3D bioprinter with tissue and organ printing capabilities. The main technology-oriented research programs on 3D bioprinting are carried out in this facility. The Division initiated the 3D Bioprinting of liver construct as the part of Institute's core research program. Other research attached to the facility is development of 3D bioprinted in vitro skin toxicity systems.

Developmental Activities

Bioink for 3D bioprinting: The Division of Tissue Culture initiated the 3D Bioprinting and Biofabrication program under the Technical Research Center (TRC) program. The research aimed at developing 3D Bioprinted in vitro hepatotoxicity test system for the screening of drugs and molecules. The project was



successfully completed in different phases such as pre-printing, printing and post-printing aspects. The most important and primary achievement of the project was the bioink which is functionalized gelatin (GelMA) that forms a hydrogel on UV irradiation. The unique formulation developed is capable of shielding the harmful effect of UV irradiation while crosslinking. After basic evaluation of the bioink, currently the invention is published inviting expression of interest from industries for its commercialization.

3D Bioprinted in vitro hepatotoxicity test system: The methods for 3D bioprinting of liver constructs for in vitro hepatotoxicity testing were developed and is offered as a test system to external customers. The 3D construct is bioprinted in multiwell plates using hepatocytes and exposed to various drugs and molecules for hepatotoxicity analysis. The workflow diagram is shown in Figure 1. the hepatotoxicity test system is now offered to external customers for evaluation of liver toxicity in vitro.

Human corneal limbal stem cell derived epithelial cell sheets for ocular surface reconstruction: Transplantation of donor corneal tissue is the treatment for ocular surface damages of the eye. The scarcity of donor tissue can be addressed using bioengineered corneal tissues. Corneal tissue can be developed by cell sheet engineering technology using a temperature responsive culture substrate. The cell sheet technology is generation of tissues from cells cultured on a thermo- responsive polymeric substrate. The preparation and characterization of the thermo-responsive Poly(N-isopropylacrylamide-co-glycidyl methacrylate) polymer has been systematically documented. The studies on human corneal limbal stems cell derived epithelial cell sheets on NGMA polymer and in vivo studies in animal models are ongoing. The study will give the methodology for generation of human limbal stem cell sheet for future clinical application. This technology aims at a standardized alternative test system for animal testing and as a prediction system for clinical evaluation of drugs. The test system is currently offered to external and internal customers as non-validated non-accredited test for research.

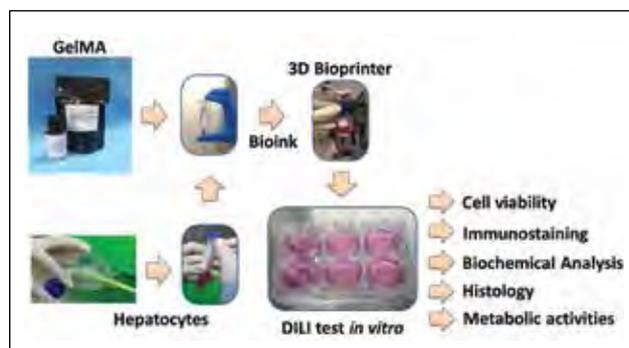


Figure 4: The in vitro 3D bioprinted hepatotoxicity test system. Liver construct is 3D bioprinted using indigenously developed GelMA bioink and crosslinked with UV. Construct are exposed to drugs and basic liver functions were analyzed.

New initiatives

In vitro test in 3D culture: The in vitro hepatotoxicity test system is extended to external customers through customer service cell. The tests are conducted in study plan mode as per specific study requirement of the customer.

Antimicrobial moisturizing oral bio-patch: Moisturizing patch has been developed for dry mouth disease Xerostomia patients with Bylin Medtech Pvt Ltd. Incubated in TiMED, SCTIMST. The efficacy and biocompatibility (under BIRAC-BIG grant) of the patch has been evaluated. The regulatory approvals for clinical trials are ongoing.

Technology transfer activities

A bioink formulation Chitra UVS-GelMA was developed for 3D bioprinting of functional tissues. The product is at Technology Readiness Level 3 and has been notified for inviting Expression of Interest.

Research programs

Pre-validation of 3D bioprinted in vitro hepatotoxicity test system: It is necessary to validate the in vitro 3D Bioprinted hepatotoxicity test system. A pre-validation program was started to extend the proof of concept to a validated in vitro test system. Three drugs were evaluated for the half maximal inhibitory concentrations. The exposure of drugs to 3D

bioprinted constructs is ongoing.

Efficacy Evaluation of 3D Bioprinted Liver Constructs Established from Niche Specific Bioink: Porcine and rat liver was decellularized and confirmed the removal of cells by histological analysis. ECM proteins from decellularized porcine liver (pECM) and rat liver (rECM) were supplemented to functionalized gelatin such as allylated gelatin and methacrylated gelatin prepolymer solution. Both GelAGE-pECM and GelMA-rECM formulation were non-cytotoxic as per direct contact cytotoxicity test. The 3D printing parameters were optimized. The GelMA was implanted subcutaneously in rabbit model and in the liver of rat model. The GelMA was confirmed to be biocompatible without any adverse reaction to host.

Bioengineered construct with cardiac mesenchymal cells for myocardial repair: As a natural biopolymer, collagen provides a milieu for cells and several medical devices including wound dressing, hemostatic agent and engineered constructs for tissue engineering applications. We have developed a simple method of producing high yields of native atelocollagen from bovine tendon economically followed by a modification that allows it to solubilize at physiological pH. A method to prepare hybrid hydrogels with the modified atelocollagen and modified gelatin or hydroxypropyl methyl cellulose or polyvinyl alcohol that can be reconstituted into various forms including membrane and 3-dimensional scaffold. The hybrid hydrogels from this process can be configured with or without other natural or synthetic polymers to form artificial skin, bone, blood vessels, fascia, cartilaginous tissue like knee menisci, ligaments, tendons etc., It can be used as filler for dermal, bone and cartilage. A method of using the hybrid hydrogel as cross-linkable bioink for 3-dimensional printing applications also developed. The stem cells or other cells based on the required tissue structure can be extruded with the hybrid hydrogel as “bioink” to form tissue engineered construct, where the “RGD” peptide present in the atelocollagen facilitate the integrin-based binding of cells.

Pre-clinical evaluation of photoprotective bioink: To protect cells from UV irradiation on longer duration, a radical scavenging bioink formulation was developed. A combination of selected molecules effectively nullified the reactive oxygen species formed during the UV exposure. The bioprinting of soft organs like liver needs high cell density in the bioink which is challenging task. A method of bioprinting liver constructs at high cell density has been done to optimize the cell number and the histo-architecture to mimic native liver tissue.

Process - property - function relationship study in silk biomaterials: In the field of silk-based biomaterials, there has been a significant amount of exploratory research documented in the literature. Numerous studies have documented the creation of SF films using a range of process parameters; however, there was no study on the effect of commonly used solvents and annealing conditions as part of a systematic process-property-function relationship analysis. In order to achieve this, we formulated and completed a current study with the hypothesis that, when processed into films after different fabrication and post fabrication treatments, SF exhibits variations in its morpho-topological, physico-chemical, optical, and biological properties when used to engineer corneal tissues.

Source-dependent batch to batch variations in silk fibroin biomaterials: As a scaffolding biomaterial, silk fibroin (SF), a biopolymer obtained from *Bombyx mori* silk cocoons, offers unique properties. However, natural polymers, including SF, were criticized for preconceived source-dependent batch-to-batch variations. Therefore, this study aims to prepare SF-based films and investigate source-dependent variations, if any. For this purpose, we have sourced silk cocoons from three geographical locations in India and processed into films. Our results indicate that there were slight variations in the morphological features in the raw cocoon stage; however, once processed, there were no significant differences in their topological, physical, chemical, optical, mechanical or degradable properties.



Testing and evaluation

The Division of Tissue culture is offering the cytotoxicity evaluation of the biomaterials and biomedical devices to research and technology programs of the institute and also to external customers. Accredited and non-accredited tests are done as initial screening of materials. In vitro tests catering to the specific needs of the customers such as osteogenic study, IC50 and wound healing study, Image analysis of cell morphology evaluation has been offered to customers under study plan mode. The division participated in internal and external audit organized by the Quality Cell.

Training/outreach programs

The faculty organized a workshop on “Hands-on Training for the Processing of Scientific Images for Publication” in association with Division of Academic Affairs, SCTIMST Trivandrum (08 Apr 2022).

Invited talks

- Dr Anil Kumar P R presented (i) An invited talk on “Importance of Structure - Function Relationship in 3D Bioprinted Solid Organ Tissue Constructs” at the International Conference on Biomaterials, Regenerative Medicine and Devices - BioRemedi 2022, organized by Society for Biomaterials and Artificial Organs India during 15-18 December 2022 in IIT Guwahati; (ii) An invited lecture on the topic “Biocompatibility evaluation of Bioink for Three Dimensional Bioprinting of Liver” at the 16th International conference on Polymer Science & Technology (SPSI - MACRO - 2022) at CSIR-National Chemical Laboratory, Pune on 2-4 November, 2022; (iii) An invited lecture on the topic “3D bioprinting: Manufacturing Personalized Organs on Demand” at the 11th International Conference and Exhibition on 3D Printing & Additive Manufacturing Technologies – AM 2022 organized by the Additive Manufacturing Society of India at Hotel Lalit Asok, Bengaluru on 14th October 2022.
- Dr Kasoju N presented (i) “Engineering Tissues In Vitro: Emphasis on Smart and Sustainable

Biomaterials and Scaffolding Technologies” in the 11th Annual International Conference of the Indian Academy of Biomedical Sciences organized by NIMHANS, Bengaluru (3-5 Mar 2023); (ii) “Stem Cells and Biomaterials Based Integrated Approaches in Tissue Engineering and Regenerative Medicine”. International Conference on Bioengineering and Biosciences organized by School of Bioeng. & Biosci., Lovely Professional University, Phagwara, Punjab (18-19 Nov 2022, Virtual); (iii) “Biomaterials and Technologies for Fabrication of Tissues In Vitro. Advanced Materials World Congress organized by International Association of Advanced Materials, Sweden (13 Oct 2022, Virtual); (iv) “Bio-Manufacturing Human Tissues In Vitro: From Formulation to Applications 6th International Conference on 3D Printing (Additive Manufacturing) Technologies and Digital Industries”, Bucharest, Romania (22-23 Nov 2022, Virtual).

Achievements

- Dr Naresh Kasoju, has been selected as Early Career Editorial Board Member of the Bioactive Materials journal (impact factor 14.593).
- Dr Naresh Kasoju and Dr Anil Kumar P R, along with Dr Linh Nguyen from UCL, London, guest edited a special issue on “Nano-Tissue Engineering: Nanomaterials and Nanoengineered Systems in Fabricating Artificial Tissues” as part of Journal of Nanomaterials (IF 2.986) published by Hindawi Publishing Group (Aug 2021).
- Dr Naresh Kasoju obtained additional qualification of PG Diploma in Medical Device Management from Institute of Good Manufacturing Practices, Noida in e-learning mode (2021).



DIVISION OF TISSUE ENGINEERING AND REGENERATIVE TECHNOLOGIES

The main research aim of this Division is the designing of suitable biological substitutes/ tissue engineered constructs through the principles of tissue engineering and wound dressing development. The mission is to promote research and development in biomedical engineering and technology especially in the realm of tissue regeneration and repair.

The research of the division is directed to develop (i) novel, biodegradable and bio mimetic “designer” scaffolds (ii) understand the regeneration process using adult cells and directed stem cell differentiation and (iii) delineate the molecular pathways that regulates the growth factors and other molecules or drugs to promote regeneration. Other areas of our interest deal with the use of bioprinting technology to generate cell incorporated tissue constructs for varying applications and also development of advanced wound dressings. Scaffolds and biomaterials made by conventional techniques, electro spinning, 3D bioprinting as well as regulator combinations generated by our division, find additional medical applications as products for drug delivery, wound healing and haemostats.

Developmental activities

‘Designer small diameter vascular grafts for reduced neointimal hyperplasia through triggered release of All-trans retinoic acid (atRA) from biofunctionalized Gelatin-vinyl acetate-PCL fibrous scaffolds’ (DST Serb POWER Grant): In this study we propose to use nanoparticles with varied pore sizes to encapsulate the morphogen atRA and study the release kinetics after loading these nanoparticles into electrospun Gelatin vinyl acetate-PCL meshes which can be used as a scaffold for small diameter blood vessel graft. In vitro studies probing the differentiation of adipose derive mesenchymal stem cell to smooth muscle lineage and the preservation of the contractility function will be studied. The efficacy of the treatment and atRA delivery system as small diameter vascular graft will be evaluated using an ovine carotid artery graft model. Through this proposal we expect to find a solution to the long standing holy grail in the development of scaffold for tissue engineering of small diameter blood

vessel and also a solution to the problem of neointimal hyperplasia by an atRA releasing graft treatment strategy.

In addition to this project, research in the area of wound dressing development and development of highly specific and biomimetic scaffolds for osteochondral, chondral, cardiovascular and pancreatic tissue engineering are long term projects being pursued in the division.

New initiatives

- DBT ATGC 5th call proposal on “Technology Development and Clinical Validation of an Injectable Hydrogel for Repair of Articular Cartilage Defects” submitted by Dr Lynda V Thomas got sanctioned with 80.97 lakhs for two years.
- DST SERB POWER Grant proposal on the topic ‘Designer small diameter vascular grafts for reduced neointimal hyperplasia through triggered release of All-trans retinoic acid (atRA) from biofunctionalized Gelatin-vinyl acetate-PCL fibrous scaffolds’ was initiated in July 2022.
- DST SERB CRG proposal on the topic ‘Chondroinductive and chondroprotective small molecules decorated photocrosslinkable gel matrix systems for Autologous Chondrocyte Implantation (ACI) – a regenerative approach’ submitted by Dr Lynda V Thomas was approved for funding in Feb 2023.

Technology transfer activities

As part of technology transfer activity of the ‘Lint-Free Absorbent Dressing’, M/s Phraction Scientific is developing samples for preclinical trials.

Research programs

Insulin producing organoids differentiated from mesenchymal stem cells in polymer encapsulated 3D scaffold to treat diabetes: This work deals with the development of a tissue engineered construct with stem cell differentiated Islet-like clusters (ILCs) seeded on a 3D natural scaffold, and coated with alginate for mitigating foreign body response in vivo. The whole



system was encapsulated in a 3D printed polymeric immuno-protection bags for further immuno-isolation from the host system. The construct was implanted in the intraperitoneal space of Wistar rats treated with streptozotocin, which is an animal model for chemically induced type 1 diabetes.

The observation period was 2 months, with blood glucose and body weight was monitoring every 7 days. After the implantation periods, animals were euthanized and transplanted construct and organs were retrieved for further histological analysis. In vivo analysis demonstrated that they could reduce the blood glucose concentration of diabetic rat model and prolong the life span of transplanted animals. Histology of retrieved construct showed that implantation of tissue engineered construct without any immunoprotection membrane leads to the formation of thick fibrotic layer around the construct that further reduce the functionality of implant. The fibrotic layer formation on IPTD was very less did not affected the mass transfer. In groups transplanted with IPTD, the islet/ILCs exhibited spherical morphology and expressed insulin hormone.

Designer small diameter vascular grafts for reduced neointimal hyperplasia through triggered release of All-trans retinoic acid (atRA) from biofunctionalized Gelatin-vinyl acetate-PCL fibrous scaffolds : Reduction of intimal hyperplasia is one of the current focus for the synthetic small diameter vascular grafts. All trans retinoic acid (atRA), the trans isomer, diffuses through the cell membrane and has also been shown to promote the differentiation of stem cells to smooth muscle cells (SMC) by signalling through the retinoic acid receptor in the nucleus, which, in turn, can bind to the retinoid X receptors. This vitamin A analogue also has a variety of physiologic effects, including modulation of cell growth and programmed cell death. Retinoic acid decreases MMP secretion and activity in cell culture and decreases migration and proliferation of smooth muscle cells that have been stimulated by other mitogens in vitro. Hence the development of a platform enabling localized and controlled delivery of ATRA is a challenge wherein much smaller effective dosage will be possible that is controlled and localized. Hence, in this study we are

developing electrospun grafts and encapsulating the morphogen atRA within nanoparticles and studying the release kinetics which can be used as a scaffold for small diameter blood vessel graft. Initial studies on the development of electrospun grafts (Gelatin-vinyl acetate/PCL/PVOH) have been started and the optimisation of the electrospinning parameters are being performed. Isolation of Adipose derived mesenchymal stem cells from sheep has also been performed.

Small molecules decorated photocrosslinkable gel system enabling chondrogenic differentiation of mesenchymal stem cells towards a “microfracture plus” therapeutic strategy: The incidence of cartilage injury or damage is quite common and may prove traumatic or degenerative. There are many treatments or repair strategies depending on the extent and nature of cartilage damage. Microfracture technique (lesion area > 2cm²) is a very common surgical intervention where holes are drilled in the subchondral bone after debriding off the damaged cartilage thereby populating the defect site with bone marrow progenitor cells that aids to provide regeneration and repair. However, containment of the cells within the defect site is a challenge. We propose the use of small molecule decorated hydrogel systems which can be easily delivered to the defect site and the small molecules that get released will enable chondrogenic differentiation of the stem cells. These hydrogel systems have the advantages that it helps in better diffusion of hydrophilic substrates such as nutrients and growth factors. To evaluate the potential of the small molecule decorated photo-crosslinkable hydrogel system in enabling chondrogenic differentiation we are using adipose derived mesenchymal stem cells in this study.

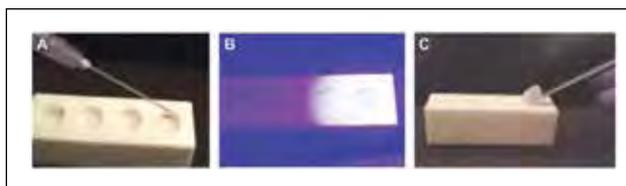


Figure 5: Injectable gel using CHMA and PEGDA in moulds (A) and photo-crosslinking (B) to obtain the sample (C).

Manuka honey loaded chitosan-PVA foam dressings for advanced wound care: Chronic wounds such as diabetic foot ulcers and pressure sores needs appropriate wound dressing is the first phase of wound management. Manuka honey has been used over the years as a traditional method to enhance wound healing. In this study, we explore a combination of anti-inflammatory, antimicrobial properties in a mechanically stable Chitosan-PVA foam dressing. The Chitosan-PVA dressing developed in the laboratory has found immense potential as lint free absorbent dressing with low bioadhesive properties. The methyl glyoxal present in the Manuka Honey additionally will enable crosslinking of the hydroxyl moieties in the dressing and also contribute to the

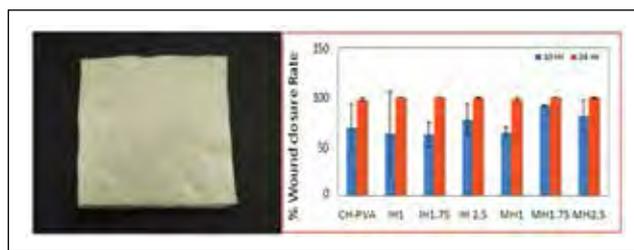


Figure 6: Picture (left) shows the Manuka loaded Chitosan/PVA wound dressing. The graph (right) depicts the percentage wound closure rate on conducting the scratch wound assay at 10h and 24 h time points.

healing process. Controlled lyophilization process is employed for developing the controlled pore size foam dressings. Here we have used Manuka honey with a MGO of 115+ in different concentrations and prepared wound dressings with a thickness of 0.5 cm. The in vitro evaluation studies showed that dressings had good absorption rate in the range of 0.5 - 0.6 g/cm²/day and MVTR in the range of 0.0100 - 0.0200 g/cm²/day and with good conformability.

Academic activities

- Dr Amrita Natarajan successfully defended her PhD thesis on 20.12.2022.
- Ms Anjitha Prasad was conferred the MPhil degree on the 38th Annual Convocation in May 2022.

Outreach activities

- Dr Lynda delivered an invited talk at the 9th Annual Research Symposium of the Centre for BioSystems Science and Engineering (BSSE), Indian Institute of Science, Bangalore on 21.01.2023.

Other significant achievements

- Dr Lynda attended the DST sponsored “Training Program on Integrated Scientific Project Management for Women Scientists and Technologists, from February 6-10, 2023” at the Centre for Organization Development, Hyderabad.
- Dr Lynda V Thomas attended the International Women’s Day celebration of the Institute on 8th March 2023 and won third prize for the photography contest that was organized during the function.

DIVISION OF THROMBOSIS RESEARCH

The Division of Thrombosis Research contribute significantly in medical device testing (blood compatibility testing as per ISO10993-4), research and product development. The division provides technical support for the product development activities of the Institute and contribute significantly to the academic programmes. In research and development, our focus is blood derived products, 3D bio-printed tissue construct, combinational matrices and point of care devices. The laboratory offers 22 COFRAC accredited tests for blood material interaction studies for medical devices and provides testing services for national and international medical device industries. The Laboratory is participating in the Proficiency Testing Programme conducted by RCPA for the year 2023.

Developmental activities

Point of care PRP isolation device: A working model of point of care PRP isolation device was made and its functionality was evaluated. Platelet isolation efficacy of the developed model device was compared with four commercial devices. Sterile isolation of PRP using the model device was evaluated. A locking system to



facilitate a second spinning of the device was designed and 3D printed.

Point of care Prothrombin time assay platform: Device design was improvised compared to previous version and was discussed with industrial team. More than 100 samples were tested for different PT/ INR range (2-7). Data showed improved accuracy. A new project proposal based on this preliminary data was submitted under DST-TDP programme which has got recommended.

Fibrin Glue: Isolation of human fibrinogen and thrombin was carried from fresh frozen plasma. Three consistent batches of fibrinogen and thrombin was prepared. Thrombin isolation process was optimised to minimize the colour of methylene blue, increase the yield and to reduce processing time. Consistency of thrombin isolation from different batches of fresh frozen plasma was established. Fibrinogen isolation optimization is ongoing to enhance solubility after lyophilisation.

Multicomponent Bioink: An ideal bioink is the most critical component for bioprinting of tissue constructs for drug testing. We optimized the process of development of a multi-component bioink formulation based on alginate-cellulose-gelatin and collagen peptide to enhance its stability after mixing individual components. The stability evaluation of the bioink formulation is ongoing.

Stabilized blood controls: Stabilized blood controls are routinely used in haematology analysers to ensure the accuracy and reliability of test results. Experiments were carried out to develop a universal stabilized blood controls from blood cells after individually fixing different blood cells using specific fixatives. We carried out stability studies of the stabilized blood up to 23 weeks and promising results were obtained. We are also evaluating the effect stabilizer along with fixative to enhance stability of blood controls.

New initiatives

- A project is initiated to develop a cost-effective strategy to isolate a therapeutic growth factor cocktail from the PRP which can be stored

for longer period of time for its application in regenerative medicine and Haemostasis. PRP is routinely collected in all blood banks for its application in haemostasis during traumatic injury and surgeries. After five days, the platelet units are discarded. Platelet units contains large amount of growth factors and will be used as the source.

- New project entitled “Exploring the effect of secretome of platelet-mesenchymal stem cells spheroids on angiogenesis and healing in chronic wounds” got approval for funding from DST POWER GRANT (Amount: 44.8 lakhs). PI: Dr Anugya Bhatt, Co PI: Dr Renjith P Nair.
- A new project entitled “Development of the assay platform for prothrombin time/INR” was sanctioned under DST-TDP programme. This programme focuses on the development of the point of care device for the prothrombin time detection.



Figure 7: Collagen peptide incorporated Chitosan-fibrin patch

Research programs

Development of haemostatic wound healing patches: In emergency situations such as battlefields and hospitals, hemostatic materials are needed for saving lives. High-performance hemostatic materials, need to be developed to improve hemostatic efficiency. High-performing hemostatic materials with biomimetic cues for wound healing may enhance its applicability.



A collagen peptide incorporated Chitosan–fibrin patch for hemostatic and wound healing applications was explored and its efficacy on blood clotting was evaluated compared to commercially available wound dressings. Material was found to be enhancing wound healing.

Optimization of bioink formulation for 3D bioprinted tissue construct: A optimum hydrogel formulation is needed for any 3D bioprinting application. Here, we have optimized hydrogel formulation containing Sodium Alginate, Collagen peptide, fibrinogen, thrombin, and CaCl₂ as crosslinkers using varying concentration of individual components. Among the 60 formulations tested, 2 were selected initially based on the gelation property. The printability of the selected samples has been tested manually and with an extrusion-based bioprinter. The selected samples were

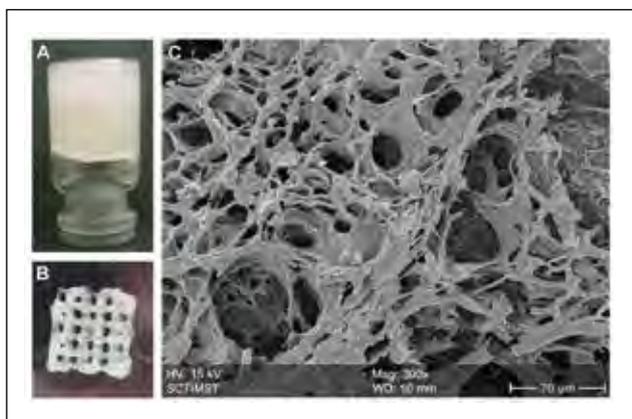


Figure 8: The bioink formulation - A) Inversion test for gelation, B) Printability evaluation using extrusion bioprinter and C) SEM image of the lyophilized printed construct

put for swelling and degradations studies, rheological analysis, Fourier transforms Infrared spectroscopy, and Scanning electron microscopy, compression test, cytocompatibility and hemocompatibility. Samples were found to be non-haemolytic non cytotoxic. Rat skin cells were isolated and characterized. Optimization of cellular construct is ongoing.

Mesenchymal stem cells-platelet interaction and wound healing: For a wound to heal cellular interaction are crucial. Platelets play a very

important role in wound healing and interacts with the neighbouring cells to promote wound healing. Mesenchymal stem cells (MSCs) are also known to be cells of choice for wound healing application due to its high therapeutic potential and non-immunogenicity. These cells primarily act through their secretome, which is promising for cell free therapeutic approach in wound healing. In the work, adipose tissue derived mesenchymal stem cells (ADMSCs) were isolated from rabbit and cultured under laboratory conditions. Cells were characterized by trilineage differentiation. MSCs secretome was collected from confluent MSCs culture. To analyze the platelet MSCs interaction, Platelet rich plasma was isolated and incubated with rabbit adipose tissue derived mesenchymal stem cells. PRP-conditioned media was collected after 48hrs. To study the effect of MSC conditioned media and

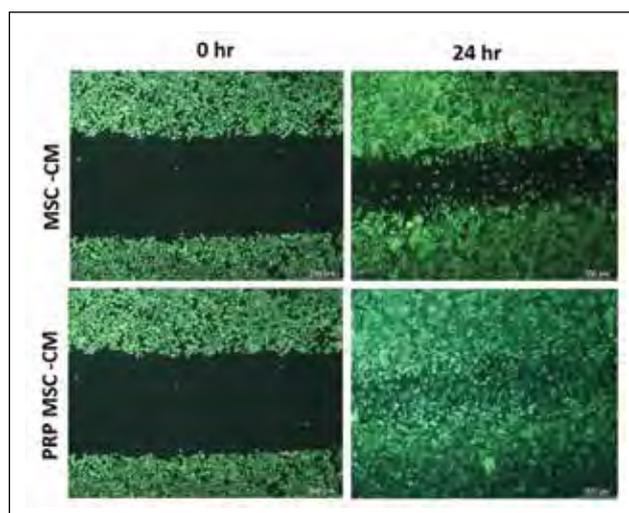


Figure 9: The effect of MSC conditioned medium and PRP-MSC conditioned medium on in-vitro cell migration by scratch wound assay for 24hrs. PRP MSC-CM treated cells showed a significant increase in wound closure compared to MSC-CM treated cells.

PRP-MSC conditioned media on wound healing, in-vitro assays such as cell migration, scratch wound assay, Agarose drop cell migration assay and hanging drop assay, were done. It was evident from the data that PRP-MSC conditioned media enhances wound healing compared to MSC conditioned and control media (media without FBS, untreated cells).

Leukodepletion filter media development and blood filtration: Leukodepletion is a mandatory requirement for blood transfusion in European countries and USA. In India, however, its limited to pediatric patients due to the high cost of the leukofilters. In this study we aim to develop an effective filter media and its filtration efficiency. Different filter media were fabricated through electrospun membranes from (N-vinyl pyrrolidone) NVP cross-linked poly ethylene co-vinyl alcohol (EVAL). The physico-chemical characterization of the fabricated membranes was done by SEM, FTIR, UV-Visible spectroscopy and contact angle measurement. It is confirmed that the modified EVAL membrane has improved wettability characteristics. The cytotoxicity test by direct contact method and MTT assay confirmed that materials are non-cytotoxic. From the blood filtration studies it is understood that the WBC adhesion is about 76.6%, RBC recovery is 60.1% and platelet adhesion is 67.6 % for modified EVAL. The membrane needs further improvisation for better filtration efficiency and improved flow rate.

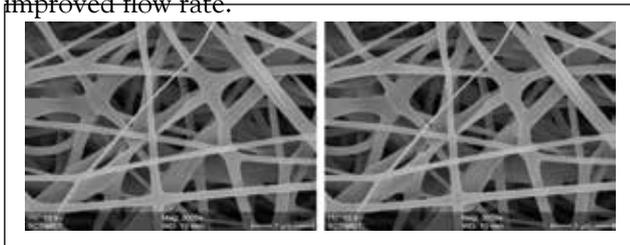


Figure 10: SEM images of modified membrane at different magnifications.

Plasma surface treatment is another method used to improve the wettability of the modified and unmodified poly ethylene co-vinyl alcohol membrane. It was found that water contact angle of plasma modified samples was improved significantly after plasma treatment. Filtration studies for the new membranes are ongoing.

Testing and evaluation

- Various COFRAC accredited and non-accredited tests were performed to evaluate materials/ components used for devices that come in contact with blood for internal and external customers. Several internal and external patient samples were tested for platelet functions

as special service. During the year, a total of 252 test reports were issued.

- Enrolled in the Proficiency Testing Programme conducted by the Royal College of Pathologists of Australasia for the year 2023

Training/outreach programs

- Dr Renjith P Nair (i) delivered invited talks for the 'Prakashadhara' and 'Yuvavani' programme of All India Radio, Thiruvananthapuram; (ii) presented a paper entitled 'Collagen peptide incorporated fibrin-chitosan patches for haemostasis and wound healing' for BIO-Remedi 2022 (International conference on Biomaterials, Regenerative Medicine and Devices) will be held at IIT Guwahati, India from 14th-18th December 2022; and (iii) Organized a three day hands on workshop on Flow cytometry at BMT Wing, SCTIMST (15th - 17th March 2023)

Achievements

- Dr Renjith P Nair was selected as Guest Editor for the international journal "JoVE"

DIVISION OF TOXICOLOGY

Toxicology Division is a premier laboratory in the country in the field of biomaterial toxicology and is accredited by COFRAC France as per ISO 17025. The division has full-fledged facility for the pre-clinical safety and toxicity evaluation of various materials and medical devices as per International Standards such as ISO, USP and ASTM. The toxicological studies are an integral and indispensable part of development of medical device technology. The main aim of the division is the toxicity/biocompatibility evaluation of materials, medical devices, tissue engineered products intended for the fabrication of medical products and investigation of potential safety/biological hazards of nanomaterials used for health care applications.

Developmental activities

- Vascularised multi-organ-on-a-chip for biological evaluation (ongoing DST Project).
- Multi-organ-on-a-chip with radial fluidic



channel for biological evaluation (ongoing DST Project).

- Validation of 'A kit for the evaluation of pyrogenicity and a methodology of preparing the same'.

New Initiatives

- Development of 'Human-on-a-Chip' device is the initiative during this year, which is supported by Dept of Science and Technology, Govt. of India
- Development of Anti-microbial peptide loaded multifunctional 3D collagen scaffold for vascularised bone tissue regeneration is another initiative under Indian-Japan Cooperative Science and Technology Programme (IJCSP), Govt. of India.

Research programs

Development of 'Human-on-a-Chip' technology: A paradigm shift in biological evaluation and disease model. The 'human-on-a-chip' is a microfluidics system for living cells culturing in continuously perfused, micrometer sized chambers, in order to model physiological functions of tissue and organs. This technology aims to combine several organ equivalents within a human like metabolizing environment or in vivo like environment. The expected outcome will be to develop an indigenous human-on-a-chip device for the pre-clinical toxicity/safety evaluations and disease modelling. PI: Dr. PV Mohanan; Funding agency: DST; Funds: 311.82L; Status: Completed in October 2022.

Anti-microbial peptide loaded multifunctional 3D collagen scaffold for vascularized bone tissue regeneration: Development of a functional 3D Collagen scaffold with antimicrobial activity and improved bioactivity that enhances not only osteogenesis/ bone regeneration but also neo-vascularization in bone defect model. This is achieved by the sustained release of LL37 in the vicinity of porous surfaces on the scaffold that will prevent bacterial infection and enhance bone regeneration and neo-vascularization. PI: Dr. PV Mohanan; Funding agency: Indo-Japan Collaboration; Funds: 5.24L; Status: Completed in

October 2022.

Toxicological Evaluations of Materials /medical devices: Toxicity screening of materials or medical devices developed/developing under TRC project. PI: Dr. PV Mohanan; Funding agency: TRC; Funds: 45L; Status: ongoing.

PhD works ongoing :

(i) Multi organ on a chip for toxicity evaluation of target organs (CSIR, Ongoing); (ii) Multi-organ-on-a-chip consisting of blood-brain-barrier for the assessment of nanotoxicology (UGC, Ongoing); (iii) Design and fabrication of organ-on-a-chip for toxicity evaluation (CSIR, Ongoing); (iv) Multi-organ chip for the disease model and the assessment of nano-based therapeutics (DST, Ongoing); (v) Biological interactions of 2D Zn-Al layered double hydroxides (LDHs) in in vitro and in vivo systems (SCTIMST, Completed); and (vi) Bio-nano interactions of polymer-coated Titanium dioxide nanotubes (CSIR, Completed).

Testing and evaluation

Tests carried out during 2022-23 (Tests and the number of samples given):

Accredited tests (53 tests done and 55 reports sent)

Maximization test for delayed hypersensitivity – 7; Closed Patch test for delayed hypersensitivity – 2; Animal Intracutaneous reactivity Test – 4; Acute systemic toxicity test: Intravenous – 10; Acute systemic toxicity test: Intraperitoneal – 10; Pyrogen Test - 1; Muscle Implantation - 1; Subcutaneous implantation – 1; Bone Implantation – 1; Animal irritation – 1; Haemolysis – 1; Penile irritation – 1; Vaginal Irritation – 1.

Collaborative Work (24 tests done and 19 reports sent).

Physico-Chemical Analysis of Potable Water -16; Haematology analysis – 2; Implantation in brain – 3; Implantation in subcutaneous tissue – 1; Conductivity measurement – 1.



Quality system improvement activities:

Actively participated in the quality system improvement activities.

- Successfully completed the COFRAC, France inspection without any noncompliance/ observations.
- 17 accredited Work Procedures revised/reviewed.
- 2 non-accredited Work Procedures revised/ reviewed.

3 Corrective and Preventive Actions generated and closed.

Training/Outreach programs

Dr. PV Mohanan participated in the following – (i) In the Webinar on NABCB Accreditation for Inspection Bodies, and its Benefits to Industry & Government Bodies on 29.04.2022, organized by National Accreditation Board for Certification Bodies, Quality Council of India, New Delhi; (ii) As a resource person at the workshop on Quality assurance evaluation during 6 - 7 June 2022 at IIBAT Chennai; (iii) In the Interactive session/Workshop of RCGM Members on 18.07.22, organized by Dept. of Biotechnology, New Delhi; (iv) As an expert committee member at the 'On-the-spot Assessment by DST's Expert Group on Project Supported to HRG, Shimla & STD, Mandi (HP) during 2-4th November 2022; (v) As a member of RCGM, at the Stakeholder Consultation meeting on the 'Streamlining Of Regulation For Biopharma Drug Development' on 24.11.22 at Department of Biotechnology, New Delhi (online) ; (vi) participated as the Chairperson of the expert committee for review of proposals submitted under the ICMR-DFG Proposals 2022, on 10.02.23 at ICMR Head Quarters, New Delhi; (vii) delivered an invited talk entitled 'Emerging role of organ-on-a-chip technologies for biological application' at the 7th Asia Pacific ISSX meeting and Society for the Study of Xenobiotics (SSX), India, held during 30th January to 1st February 2023 at Bangalore.

Recognitions

Dr. PV Mohanan had the following recognitions this year – (i) nominated as an Adjunct Professor in

the Department of Biomedical Engineering, Indian Institute of Technology Hyderabad; (ii) nominated as member at the Expert Committee on RCGM (Review Committee on Genetic Manipulation, Department of Biotechnology, Govt. of India, New Delhi; (iii) nominated as Member of the Scientific Advisory Committee of ICMR-National Animal Resource Facility for Biomedical Research, Hyderabad, ICMR vide letter No.73/02/2022-NAR/SAC/BMS, dated 07.07.2022; (iv) participated as an expert member at the Meeting of the Programme Advisory Committee (PAC) of Kerala Biotechnology Re-Entry Fellowship (K-BiREF), under Kerala Biotechnology Commission, KSCSTE on 16.06.22 (online) ; (v) nominated as an expert member of Program Advisory Committee (PAC) of Kerala Biotechnology Re-entry Fellowship (K-BiREF) program under Kerala Biotechnology Commission, KSCSTE; (vi) nominated as a member at Scientific Panel on Food Additives, Flavorings, processing aids and materials in contact with food. Food Safety and Standards Authority of India (FSSAI), Govt of India; (vii) nominated as a member and Co-Chair for Interdisciplinary Biological Sciences of the Search-cum-selection committee for SERB-Power grant, SERB, DST New Delhi; (viii) participated as an expert committee member at the Monitoring Committee of CSIR-Fundamental & Innovative Research in Science of Tomorrow (CSIR- FIRST) Projects, on 24th January 2023 (online), organized by CSIR Head Quarters, New Delhi; and (ix) nominated as the Chairperson of the expert committee for review of proposals submitted under the ICMR-DFG Call for Proposals 2022.

Awards

- Dr Megha KB, Post Doctoral Fellow, was awarded the Gold Medal for the best oral presentation, for her research work entitled 'Development of ELISA kit for animal Pyrogen test', at the 5th Annual Conference of Society for Alternatives to Animal Experiments-India (SAAE-India 2022), held at CLIF, Karyavattom Campus, University of Kerala, during 8-9 December 2022.
- Dr Megha KB, Post Doctoral Fellow, Division of Toxicology, was awarded with the prestigious



KSHEC-Chief Minister's NAVA Kerala Post Doctoral Fellowship, for her research proposal entitled 'Peptide (HHC-36) coated 3D print montmorillonite scaffold for bone regeneration' (under the mentorship of Dr P V Mohanan, Division of Toxicology). The Award was presented by the Hon. Minister of Higher Education Dr. R. Bindu at a function organized by the Govt. of Kerala on 18th May 2022 at Mascot Hotel, Trivandrum.

- Mr Amir Suhail, PhD Scholar, has won the Third Prize in Oral Presentation, for 'Design, simulation and fabrication of Microfluidic device for toxicity analysis' (Arathi A, Amir S and Mohanan PV), at the International Seminar on Recent Trends in Omics, Regenerative & Precision Medicine: Interface between infectious & non-infectious disease, organized by Dept. of Zoology, University of Kerala, on 22-24 July 2022.

Conferences organized

Dr PV Mohanan organized the 'Sree Chitra Conclave 2022' during 17-18 October 2022.

SCTIMST and Kerala University jointly organized the 5th Annual Conference of Society for Alternatives to Animal Experiments-India (SAAE-India 2022), at CLIF, Karyavattom Campus, University of Kerala, during 8-9 December 2022.

DIVISION OF IN VIVO MODELS AND TESTING

Primary aim of the division is to support medical devices development at SCTIMST. This is achieved by developing animal models for conduct of 'proof of concept' and 'preclinical' animal evaluation of medical devices and biomaterials. As secondary aim, the division supports Indian medical device industry by conducting preclinical animal studies. The division is also involved in the development of tissue based medical devices as part of the research activity.

For the conduct of 'preclinical' or 'proof of concept' animal evaluation, physiologically normal or disease induced animal models are used. These studies

for assessing functional safety and performance of medical devices are done under GLP compliant documentation in either large animal or small animal models simulating actual clinical use in human patients. The division is hence equipped with qualified and trained staff, excellent infrastructure such as well-equipped operation theatre, catheterisation OT, clinical laboratory and Research laboratory, acute care rooms, animal preparation/explantation rooms and CCSEA registered large animal house which provides healthy, traceable large experimental animals such as pigs and sheep.

The division of its own, conducts research projects and guiding PhD students to achieve the research objectives. The overall activities of the division are guided by the following 'Mission statement'

DIMT strives for (i) Worldwide acceptance of animal research data generated here by implementing the best practices, (ii) Development of novel animal models and evaluation techniques required for safety/efficacy evaluation of emerging medical devices, (iii) Training of manpower required to sustain our core activities and (iv) Research enabling replacement to regeneration of diseased organ.

Developmental activities

Division is involved in the TRC funded project 'Development of Bioprosthetic heart valve' (with Dr. PR Umashankar as PI) was completed in June 2022. The objective of the project was to develop a bioprosthetic valve with minimum durability of 15 years. As part of this project, after studying two prototypes, the final design of bioprosthetic valve was developed and frozen. This model has met the engineering requirements of ISO 5840, such as completion of 200 million cycles in accelerated durability testing. The final model of the bioprosthetic valve has the following features (i) Novel stent design with set of 3 inserts to affix the leaflet onto the stent; (ii) Bell shaped stent design to ensure maximum orifice at given TAD; (iii) Computationally optimized leaflet design to ensure minimum pressure gradient across the valve during opening and (iv) Better pericardial processing such as surface Mg immobilization and aldehyde free liquid sterilization procedure to avoid



leaflet calcification, pericardial leaflet thrombosis and peri-valvular inflammation .

The major achievement made during 2022 is the explanation of one prototype valve on completion of 12 months in sheep model. The explanted valve prototype showed minimal calcification and good healing. Another major achievement is the fabrication of 10 final test valves and implantation of two of these in sheep orthotopic implantation model. One sheep completed 4 months duration and second sheep, 3 months. ‘GMP Tissue Harvesting Facility for Medical Devices’ at MPI Ltd, Edayar Koothattukulam, established as part of this project, has supplied 300 numbers of biomedical quality pericardium as per our

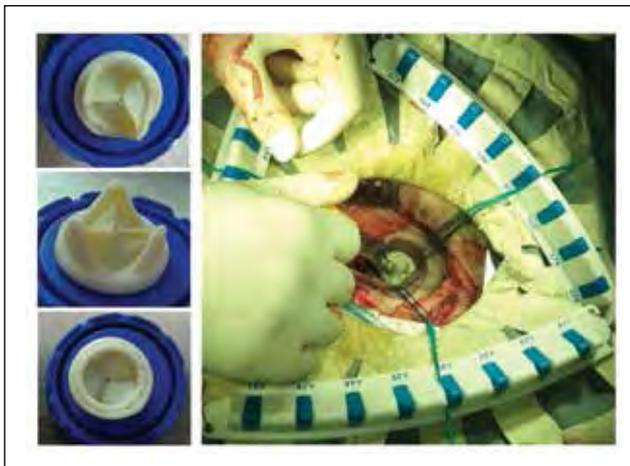


Figure 11: Pictures on the left panel show the different views of the final bioprosthetic heart valve developed. Picture on the right is implantation of the valve in sheep mitral position

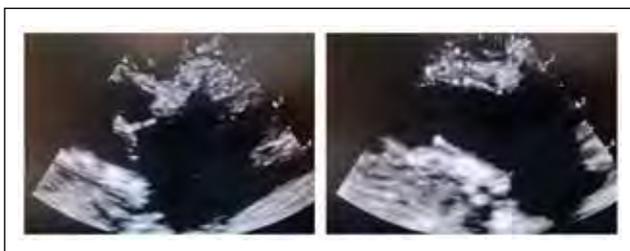


Figure 12: The closing (left picture) and the full opening (right picture) of the implanted valve in sheep, demonstrated by immediate post-operative epicardial echocardiography. Note the nearly 40% leaflet apposition during valve closure

purchase order. Thus this project is completing its POC phase.

Research programs

TDF project on ‘Developing decellularised porcine pericardium with enhanced strength for paediatric cardio-vascular application’ is ongoing. The processing of porcine pericardium and natural biopolymer impregnation is standardized. The process produced significant increase in mechanical strength and suture retention strength. 10 batches were made and used for various in vitro and in vivo studies. Patent is applied for the above process. Pigs implanted with this pericardium as aortic patch has completed 3, 6 and 12 months and they were sacrificed and analysed. The implant was noticed to be intact with excellent healing and no indication of calcification.



Figure 13: Decellularised porcine pericardium with less than 0.1 mm thickness implanted in aorta

Histopathological evaluation of implanted samples is ongoing. Application of this biomaterial for mitral valve reconstruction is explored.

Testing and evaluation

Support for TRC projects

- Bioprosthetic valve evaluation was done in sheep orthotopic implantation model.
- Evaluation of annuloplasty ring was done in sheep orthotopic implantation model.

- Evaluation of the TiN coated coronary stent system was done in swine models.

Animal implantations for internal funded (TDF) projects

- Aortic patch of silk fibroin impregnated porcine pericardium was implanted in pig model.
- A proof-of-concept study of “Alginate dialdehyde-Gelatin as a post-surgical adhesion prevention material in thoracic surgery in swine models” is ongoing.
- ‘Developing decellularised porcine pericardium with enhanced strength for paediatric cardiovascular application’ is ongoing.

Industry support (External testing)

- Repeated the study entitled “In vivo Safety evaluation of surface modified Magnesium bone plates (MPSS) in the long bones of sheep models.”
- Study entitled “In vivo Safety evaluation of surface modified Zinc bone plates (ZPRS) in calvarium of rabbit models” is ongoing.

Animal models developed

- Rat liver punch defect model for evaluation of 3D bio-printed scaffold regeneration.

Other significant achievements

- Dr P R Umashankar was awarded Best researcher 2022 in the domain of ‘Veterinary and animal husbandry’ by Indian Veterinary Association.

Staff

Faculty

Dr Mohanan PV, Scientist-G & Head of the Department

Dr Maya Nandkumar A, Scientist G

Dr Anoopkumar Thekkuveetil, Scientist G

Dr Anilkumar TV, Scientist G

Dr Umashankar PR, Scientist G

Dr Kamalesh K Gulia, Scientist G

Dr Sabareeswaran A, Scientist G

Dr Anil Kumar PR, Scientist G

Dr Anugya Bhatt, Scientist G

Dr Sachin J. Shenoy, Scientist G

Dr Harikrishnan VS, Scientist F

Dr Lynda Velutheril Thomas, Scientist F

Dr. Remya NS, Scientist C

Dr Naresh Kasoju, Scientist C

Dr Renjith P Nair, Scientist C

Technical

Dr Geetha CS, Jr Scientific Officer (Lab)

Mr Pradeep Kumar SS, Jr. Scientific Officer (Lab)

Mr Anil Kumar V, Senior Scientific Assistant (Lab)

Mr Joseph Sebastian, Senior Scientific Assistant (Lab)

Ms Sumitha KC, Senior Scientific Assistant (Lab)

Ms Priyanka A, Senior Technical Assistant (Lab)

Mr Santhosh Kumar R, Senior Technical Assistant (Lab)

Mr Vinod D, Technical Assistant B (Lab)

Ms Manju G Nair, Technical Assistant (Lab)

Ms Sreedevi VS, Technical Assistant (LAB)-B

Ms Smitha P, Technical Assistant (Anaesthesia)-A

Ms Vandana Unnikrishnan, Technical Assistant (Lab A)

Mr Vishwanatham Naik, Technical Assistant

Mr Seenuvasan R, Technical Assistant (Lab)

Mr Manoj M, Animal Handler-B

Mr Sunil Kumar M, Animal Handler-B

Mr Harikumar. G, Animal Handler

Mr Sunil L, Animal Handler A

Mr Shaji S, Animal Care Taker

Mr Biju V, Laboratory Animal Care Taker A

Mr Manoj Kumar K, Laboratory Animal Care Taker A

Mr Pradeep Kumar B, Lab Animal attendant



DEPARTMENT OF BIOMATERIALS SCIENCE AND TECHNOLOGY

The department focuses on the development of novel biomaterials and the translation of these technologies into viable and affordable products. The research teams are pursuing state-of-the-art developmental work related to nano biomaterials, bone graft substitute materials, bioceramic coatings, drug eluting ceramic structures, advanced polymeric compositions, nano /micro delivery systems, bioactive cements, glass-ionomer cements, etc. These are being explored for various applications like bone tissue engineering, regenerative dentistry, drug and biologics delivery, photodynamic & photothermal therapy, biomaterials based sensors and diagnostic devices. Products being designed include bioceramics based graft materials, biocompatible and resorbable polymer scaffolds for tissue engineering and wound healing, and organically modified composites. The Department of Biomaterials Science and Technology has been instituted with a vision of being a centre in the country for the synthesis and evaluation of biomaterials for various biomedical applications. It consists of the following Divisions and Laboratories: (I) Division of Bioceramics, (II) Division of Biophotonics and Imaging, (III) Division of Biosurface Technology and (IV) Division of Dental Products.

DIVISION OF BIOCERAMICS

The division is primarily engaged in developing bioceramics-based tissue repair materials for orthopaedics and dentistry. The research team is working on the design of related products, their evaluation and technology transfer. Current research areas of interests are bone graft substitute materials, bioceramic coatings, drug delivery systems and regenerative dentistry.

Developmental Activities

Gypsum based bioactive self-setting formulations for endodontic tissue regeneration: An inorganic mineral cement formulation has been developed for pulp

capping purpose, based on medical grade gypsum and dihydrogen orthophosphates of sodium and strontium. The fine sub-micron crystals of this formulation are made through chemical methods and subjected to controlled calcination wherein the calcium sulfate dihydrate content gets converted to hemihydrate form. This could be readily hydrated using water, which forms a self-setting paste with a unique gelling property.

Response of Human Dental Pulp Cells (hDPCs) to the modified gypsum cement has been investigated. Microscopic evaluation by cytoskeleton staining (phalloidin) showed the retention of cell morphology and close adaptation to the new cement. This is indicative of the cytocompatibility of the cement with the dental pulp cells.

Thereafter the ability of the cement to induce differentiation in hDPCs was also investigated. Human dental pulp cells were cultured in contact with the cement discs (test and control) for 7 days. The positive expression of odontogenic markers such as alkaline phosphatase, osteonectin and dentin matrix protein 1 (DMP1) indicated that a population of the cells could differentiate to odontogenic lineage. The gypsum based bioactive cement formulation is proven to be capable of inducing differentiation of the host dental pulp cells, suggesting it to be a good candidate for pulp regeneration. The figure below illustrates the ability of the gypsum based bioactive cement to induce differentiation in Human Dental Pulp Cells (hDPCs). The pictures show positive expression of odontogenic markers (alkaline phosphatase, osteonectin and Dentin Matrix Protein 1) by hDPCs in the presence of conventional cement as well as new bioactive cement. The new bioactive cement shows better performance than the conventional cement. Scale bar is 100 microns.

Iron Oxide Nano-Bio-Composites for Biomedical



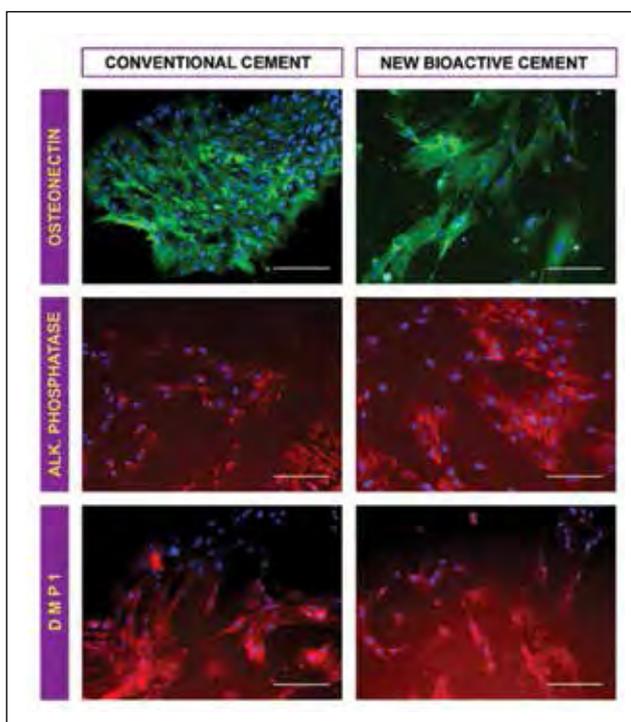


Figure 14: In vitro demonstration of the ability of the gypsum based bioactive cement to induce differentiation in Human Dental Pulp Cells (hPDCs).

Applications: Iron nanoparticles are a well explored area with a wide variety of applications in the biomedical space. We had developed synthesis routes for iron oxide nanoparticles that provide consistent, dispersed, uniformly sized particle output. These were converted into nano-bio-composites which could be used as a platform system for a range of applications.

In vitro diagnostics has a great scope wherein nanoparticles that can be guided via external magnetic field are used in lateral flow assays. This allows for quantification across the full thickness of membrane, allows for greater stability and provides a pre-concentration step for analytes of interest. Membranes for IVD design were prepared. Biocomposite of the iron nanoparticles were prepared with protein coating systems for controlled hyperthermia that is vital for therapeutic applications.

Technology transfer activities

Technology Transfer - The know-how for manufacturing the product "Drug Eluting Bioactive Calcium Sulfate

Cement", developed in the Bioceramics Division has been transferred to M/s Onyx Medicals Pvt. Ltd, Meerut, UP, on 13th September 2022. The Technology Transfer Agreement has been signed by Dr Sanjay Behari, Director, SCTIMST and Mr Harsh Vardhan, Onyx Medicals. Thereafter, the Company personnel have undergone the training of the production process for 2 weeks in the lab.

Research programs

Neuronal differentiation on axonal guidance substrate patterned with functionalized hydrogel: Synthetic biodegradable nerve guide conduits (NGC) are applied to repair small gaps in injured peripheral nerves which can substitute the autologous nerve grafts harvested from other parts of the body. The requirement of restoring complete motor and sensory functions makes the NGC design very challenging. In the present work, a biocompatible and degradable substrate of PCL-PVP was prepared and patterned in a linear fashion with a functionalized hydrogel. The gel incorporated solubilized mice stromal basement membrane proteins in Gelatine Methacrylamide (GelMA-mbmP) and the patterning was done through programmable micro extrusion followed by photo-crosslinking. Rat adrenal pheochromocytoma (PC-12) cells were seeded on the patterned substrate and maintained in RPMI Medium supplemented with 10% FBS and antibiotics. The neurite extensions were monitored under phase contrast microscope for 10 days. The results showed that the PC12 cells were specifically attaching to the Gelma-mbmP with neurite extensions selectively following the gel pattern. The study confirms that it is possible to design a nerve guide conduit that would facilitate the nerve growth guidance so that the damaged peripheral nerve ends will grow and join to reinstate the functions.

Bioactivity of cell-loaded ceramic cages with open through-pores: Hydroxyapatite porous ceramic forms are popular as bone graft substitutes. However, they act as mere scaffolds in host bone defect, because of the lack of stimulating environment inside. This limitation arises because the viable manufacturing processes will not allow open pores in the ceramic mass, thereby isolating the inner part of the ceramic from the host

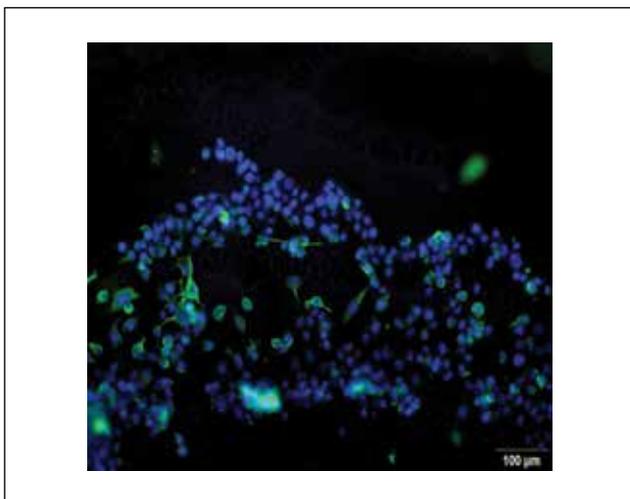


Figure 15: Immunofluorescence staining of differentiated N2A cells (tubulin) on substrate showing cell attachment and neurite extension.

tissues. The present work explores the possibility of introducing open through-pores in hydroxyapatite graft materials so as to permit cell migration, nutrient and oxygen diffusion and vascularisation to the inner part of the graft. Cage structures of hydroxyapatite were made through slip casting technique, moulding the ceramic slurry over a parallel alignment of sublimable fibres and obtaining an intact green body before the sintering step. The ceramic cage structures contained open through-channels of 800 microns diameter, in addition to the nano-pores in the bulk. L929 fibroblast cells seeded into one end of the 10 mm long cage were seen to get mobilized to the other end by capillary action. In the in vitro cell culture using HOS cell lines, the cells inside the pores were found live for five days, as identified through live dead assay (Acridine Orange and Ethidium bromide staining). The results indicate that the bioceramic grafts with open through-pores will function as biologically active graft in clinical conditions, especially if autologous bone marrow aspirate is infused.

Isolation and characterization of exosomes from rBMSC using ultracentrifugation method: Exosomes are membrane bound nano-sized vesicles of endocytic origin seen in the size range 40-200 nm. It plays significant role in cellular communication by transferring functional proteins, metabolites

and nucleic acids. An attempt was made to isolate exosomes from rat bone marrow derived mesenchymal stem cells (rBMSC) so as to identify their potential in bone tissue healing. Bone marrow from Wistar rats were collected through ethical process and cultured

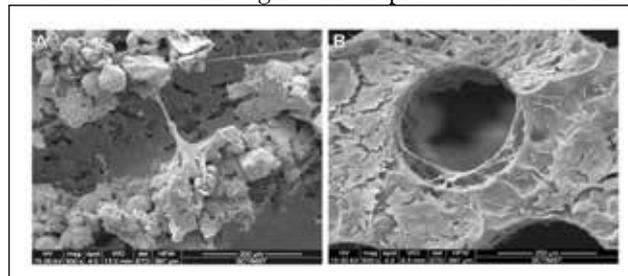


Figure 16: SEM micrographs of the ceramic cage after 5 days, cultured with HOS cells. (A) Longitudinal section- Filopodial extension seen inside channels; Cells are seen deep inside the cage. (B) Cells grown on the top edge of the cage.

at standard conditions to obtain rBMSCs. Given the very low availability of exosomes from cells, a large scale culture is needed to obtain a viable quantity. Therefore, rBMSC were grown in T175 flasks until 70-80% confluency in exosome-depleted serum supplemented media for 48h in CO₂ incubator. The cell culture media was harvested and stored at 4°C until isolation. Ultracentrifugation procedure was followed to obtain pellet of the extracellular vesicles, which was re-suspended in 1x PBS and stored at -80°C.

Exosomes in the pellet were fixed in 1% glutaraldehyde for particle observation. The particle size distribution was determined through dynamic light scattering (DLS - Malvern Zetasizer) technique. Excellent homogeneity in size distribution was observed, with a mean particle diameter of 157 nm. TEM analysis showed typical exosome appearance. The total protein concentration of sample estimated by BCA assay was 2.8 μg/μl and 3 μg/μl for exosome samples isolated by treating serum of the preparations 1:3 dilutions with media and overnight ultracentrifugation, respectively. SDS-PAGE followed by Coomassie staining identified a wide range of protein bands for the exosomal sample in both the isolates between the range of 250-20 kDa. Total cell lysate (TCL) was loaded as a positive control and no bands were detected for PBS supernatants.

Characterization of exosome preparation was done by western blot and some of the common exosome markers like HSP90 α , TSG101 was detected.

Testing and evaluation

The Division provides testing services for materials characterization - (i) X-Ray Diffractometry, (ii) Microhardness testing, (iii) Infrared spectrometry and (iv) Elemental analysis using AES-ICP.

Training/outreach programs

- Mr Adarsh RK, Ph.D. student under the guidance of Dr. Manoj Komath, appeared for the defense of the thesis entitled “Polymer Modification Strategies to Develop New Bioactive Structures for Guided Tissue Regeneration” on 20.09.2022 and successfully fulfilled the formalities for Ph.D. degree
- Dr Manoj Komath delivered a talk on Science Program in All India Radio, Kannur, featuring ‘James Webb Space Telescope’, which has been broadcasted on 06.09.2022, 7.30pm.
- Dr Manoj Komath delivered a talk on ‘Translational Aspects of Biomedical Technology’ at the Inter University Center for Evolutionary and Integrative Biology (iCEIB), University of Kerala on 06.12.22 as an invited speaker for their 9th Institution Day.

Achievements

Ms Ganga Anand G, Ph.D. scholar working under the supervision of Dr Manoj Komath, has won the Best Oral Presentation Award in the International Conference on Molecular Medicine and Therapeutics (ICMT-2023) held during 7-9 January 2023, at the Department of Biochemistry and Biotechnology, Annamalai University, for the paper entitled “Isolation and Characterization of rat bone marrow mesenchymal stem cell derived exosomes and its role in bone regeneration”.

DIVISION OF BIO PHOTONICS AND IMAGING

Major objective of the division is to synthesize different nanostructures and nanostructure-based devices for biomedical applications like diagnosis, therapy. These biomedical applications include Photothermal and photodynamic therapy for cancer, nano-particle-based biosensors, nano-theranostics in neurodegenerative disease etc. The division also focuses on the evaluation of nanomaterials in vitro and in vivo.

Developmental activities

Lateral flow assay (LFA) is a versatile and cost-effective diagnosis technique used for the detection of a wide range of analytes. We have developed a nanozyme based LFA kit to detect COVID-19 specific spike protein with high sensitivity and selectivity with the option for quantitative measurement. Generally, 3,3',5,5'-Tetramethylbenzidine (TMB) is used as a nanozyme substrate in nanozyme based LFA. However, the coloured product of TMB is sensitive to light and the intensity of colour decreases over time, limiting its application in LFA. Herein, we have utilized gold nanoparticles as a peroxidase mimicking nanozyme to enhance the catalytic activity of these gold nanoparticles using different substrates for high contrast in LFA format.

With this new approach, the colour is persistent, light-insensitive, and resistant to the loss of signal that enhanced the detection limit up to 7.5 ng/ml for COVID-19 spike protein, with naked eye visibility. Smartphone-based image analysis enabled the quantitative measurement of analytes in samples.

New initiatives

- The project proposal entitled “Development of a peri-rectal radiation protection spacer” was sanctioned for funding by DRDO.
- A project proposal entitled “Fabricating NIR responsive multifunctional cascade Nano-catalyst for synergetic Chemodynamic and Photothermal therapy” was sanctioned by SERB (National Post Doctoral Fellowship).



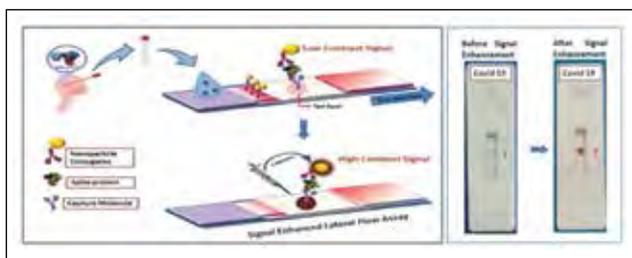


Figure 17: Detection of COVID 19 spike protein before and after signal enhancement

Research programs

Blood Brain Barrier Permeable nanocarriers for diagnosis and therapy of neurodegenerative diseases (DBT funded project): DBT funded project “Blood Brain Barrier Permeable nanocarriers for diagnosis and therapy of neurodegenerative diseases” is in progress. As part of this project, a nanoprobe was developed for the inhibition of the formation amyloid fibrils to prevent the progress of Alzheimer’s disease (AD). The probes were also permeable to BBB to treat the AD altering $A\beta$ fibrillization pathways. Additionally, the fluorescence property of the probe allows the real time imaging. This is the first study on the affinity between nanoprobe and AD causing plaques.

The efficacy of the nano-probes to cross the blood-brain barrier and its imaging property was demonstrated in vivo using a non-transgenic AD mice model.

Development of ultra-sensitive surface for the detection of biomarkers of Alzheimer’s disease: An ultra-sensitive surface for the detection of blood based biomarkers of Alzheimer’s disease (AD) has been developed using Surface enhanced optical spectroscopy (SES). for the detection of multiple AD biomarkers present in human plasma. The developed substrate illustrated as an immunoassay platform with attomolar detection limit. This is the first attempt to develop Aluminum- SERS based immunoassay platform for precise and sensitive detection of AD markers from blood. Clinical study result from AD patients, patients with mild cognitive impairment and healthy controls is shown below.

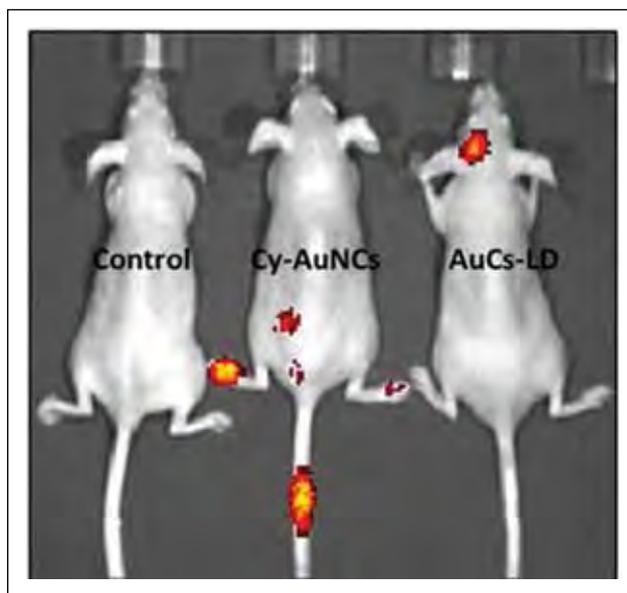


Figure 18. Imaging efficiency of gold clusters of L-dopa conjugated clusters in vivo

Portable non-electronic device for Alzheimer’s Disease biomarker detection:

We have also designed a portable nonelectronic device for AD biomarker detection. The developed device with femtomolar detection limit could discriminate the clinically diagnosed AD and MCI (Mild Cognitive Impairment) patients from healthy controls. The clinical study is going on.

Other major works include the research work of the PhD students. This includes the development of nanoparticles for radiosensitization, radiation sensing, neuromodulation etc.

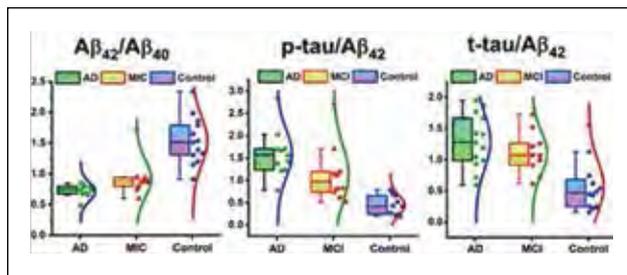


Figure 19. Results of the clinical study to diagnose Alzheimer’s disease biomarker from patient’s blood.



Service/Academic activities

- In vivo Imaging System (IVIS). This device is used for in vivo imaging of small animals such as mice and rats.
- Fourier Transform Infrared Spectroscopy (FTIR). This device is used to analyse the functional groups in various compounds.
- Fluorescence Microscopy. The device is used for

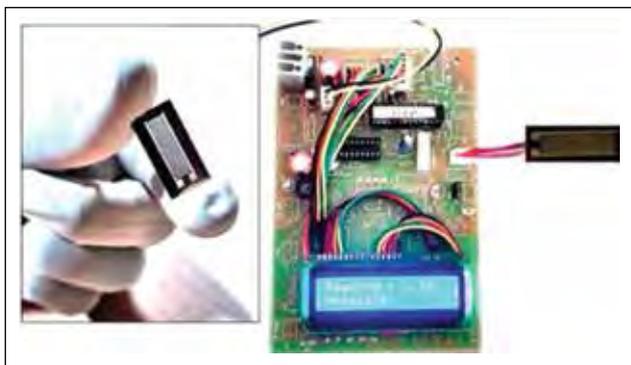


Figure 20. Portable nano-electronic device for Alzheimer's Disease biomarker detection

imaging of cells.

Training/outreach programs

1. An Outreach program for the high school students of Trivandrum district under the Science Facilitation Centre of Mar Ivanios College, Trivandrum. Dr. Jayasree RS interacted with the students and gave a class on the topic 'Medical Application of Lasers' on 08.10.22.
2. Sixteen undergraduate physics students from VTM NSS College visited BMT Wing and the Division of Biophotonics and Imaging under the 'Meet the Scientist' program on 29.08.22.
3. A training session by R S Jayasree on the topic 'Biomedical application of Nano composites' was provided to the M.Sc/M.Tech Nano Science and Technology students of M.G. University during the training programme organized by the National Institute for Rubber Training, Rubber Board, on 18.01.2023.

Faculty presentations

Jayasree RS made the following presentations - (i) 'Biomedical Applications of Laser and Nanotechnology: An SCSTIMST experience' (Invited talk) during the National Science Day Celebration of CSIR-NIIST on 28th February 2023 under the Women in Science Session ; (ii) "Nanoscale-structured materials for the management of cancer and neurodegenerative diseases" at the International Conference on Molecular Materials and Functions-2022 organized by IIT Madras and Institute of nanoscience and technology, Mohali on December 5th 2022 at IIT Madras ; (iii) "Atomically precise gold nanoclusters for the diagnosis and treatment of neurodegenerative diseases and cancer" (Keynote lecture) at the International Conference on Biomaterials Regenerative Medicine and Devices organized by Society for Tissue Engineering and Regenerative Medicine India (STERMI) in association with The Society for Biomaterials and Artificial Organs India (SBAOI), on December 15th -18th 2022 held at IIT Guwahati ; (iv) 'Surface Enhanced Raman Spectroscopy for the diagnosis of neurodegenerative diseases and cancer progression' invited talk at the ROWS webinar series organized by Raman International Optronics Society (RIOS) on 08.11.22 ; (v) "Optical imaging of brain and magnetic resonance angiography: Advances in imaging contrast agents"-Invited talk during the International Conference on advanced biomedical imaging held during January 9-11, 2023 at IIT Madras ; (vi) 'Quantum gold cluster for the management of cancer and neurodegenerative diseases' Invited talk at the International Conference organized by International Union of Materials Research Society, International Conference in Asia -19 to 23rd December 2022 held at IIT Jodhpur; and (vii) 'Liquid biopsy'- (Thematic talk) during the Conference on Women in Optics and Photonics in India at Raman Research Institute, Bangalore on 6th December, 2022.

Other significant achievements

1. Dr Jayasree RS was conferred with the ISAS Best Woman Scientist Award-2022 for her outstanding contributions in the field of biophotonics,



- bionanophotonics and biomaterial sciences, at the Indian Analytical Science Congress-2023 held at Kochi during 23rd -25th March 2023.
- Dr Jayasree RS, was conferred with the Shreeratna award-2022 by Kerala Kalakendram, an affiliate of Kerala Sangeeta Nataka Academy, Government of Kerala.
 - Royal Society of Chemistry, London enlisted Dr Jayasree RS in the Women in Nanoscience list published during the International Women's Day.
 - Mr Sarathkumar E, PhD scholar, won the best presentation award for his work "para-phenylenediamine based signal amplification for rapid and sensitive detection of covid spike protein using lateral flow assay technique"; during the MRSI annual technical meeting 2022 held on 30th April 2022 at IIST, Trivandrum.
 - Ms Resmi AN, Ph.D scholar, won the best poster presentation award under Life Science category, for the paper entitled "Bifunctional Gold nanocluster as a Theranostic probe for the management of Alzheimer's disease in the 35th Kerala Science Congress held at Idukki during 12th -14th February,2023.

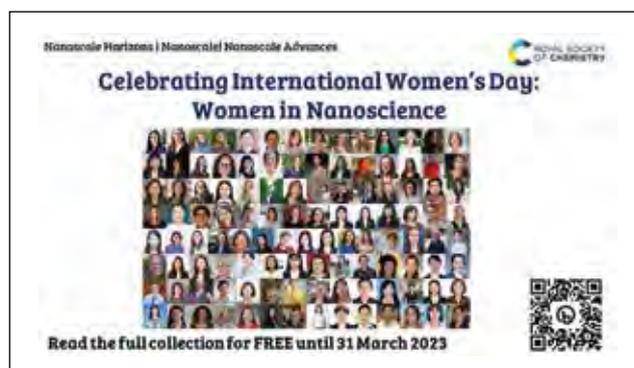


Figure 21 : List of women in Nanoscience

- Mr Sarathkumar E, PhD scholar, won the best oral presentation award at the 35th Kerala Science Congress held at Idukki during 12th -14th February, 2023, for the research work entitled "Nano enzyme-based signal amplified lateral flow assay for rapid and sensitive detection of covid-19".

- Dr.S Sivaselvam won best oral presentation award for the paper entitled 'Rapid one-pot synthesis of PAM-GO-Ag nanocomposite hydrogel by gamma-ray irradiation for remediation of emerging pharmaceutical pollutants and pathogen inactivation' in the 2nd International conference on Emerging contaminants in water and Environment ECWE 2023 from 21-22nd February conducted at PSG institute of Advanced Studies-Coimbatore.

DIVISION OF BIOSURFACE TECHNOLOGY

The main research focus is on development of biomaterials and drug delivery systems for various therapeutic applications. Main thrust is on translational research towards product development in the area of advanced wound care focusing on controlled drug delivery system for biologically active molecules and other drugs using polymeric scaffold and nano/microparticle based drug delivery systems. Division's mission is to develop polymeric biomaterial based systems (wound healing and drug delivery) for clinical applications and its translation to a product.

Developmental activities

- Hemostatic wound dressings. The haemostats under development are for external applications such as in haemorrhage following minor accidents, to stop bleeding at the catheter insertion site following a percutaneous coronary angiography. The chitosan based hemostat absorbs the blood and it gets coagulated within the sponge.
- Cell/tissue interaction with wound healing biomaterials and modulation of microenvironment for better wound healing.

New initiatives

Nasal Pack: Chitosan based sponges is designed in the form of tampons which can be easily kept within the nasal cavity. These chitosan sponges are water absorbing material which can compress the bleeding blood vessel. Moreover, the antibiotics that can be loaded onto these sponges can be delivered to the wound site following the surgery.



Research programs

Alginate based advanced wound dressings were developed by grafting with methacrylic acid monomers



Figure 22. Chitosan based hemostat

and dual cross-linked with methylene bisacrylamide and strontium ions. The efficacy of these materials for controlled delivery of selected biomolecule such as insulin, simvastatin and glucose oxidase-peroxidase (GO-POD) were performed. Alginate diamine PEG-g-poly (PEGMA) xerogels (ADPM2S2) showed good mechanical strength, less bioadhesive nature and increased cell viability. These hydrogels are able to maintain the controlled delivery of biomolecules without any structural variation. So biomolecules loaded within ADPM2S2 hydrogels were selected for further in vitro evaluations. In vitro analysis was performed under hyperglycaemic condition in various types of skin cells such as fibroblast (L929), keratinocytes (HaCaT) and macrophages (RAW 264.7) cells. Insulin loaded hydrogels showed good cellular migration, proliferation, actin filament organization and also favours collagen deposition. Simvastatin loaded hydrogels showed good cellular migration, but disruption in actin filament organization was observed. Hydrogels loaded with GO-POD could effectively regulate the local glucose level and reactive oxygen species level, which favours wound healing process. The treatment with insulin

showed an up-regulation of the genes such as colla1, keratin16, GLUT1, TGF β 1, IL-10 and CD163 and down regulated the expression of TNF α , IL-6, and CD86. Due to the improved wound healing effect compared to other biomolecules, insulin loaded hydrogel was further selected for in vivo evaluation.

loaded ADPM2S2 hydrogels in diabetic rat model. Full thickness wounds were created on streptozotocin induced diabetic Sprague Dawley rats and the rate of wound healing was analyzed at different time points. A commercial alginate wound dressing is used as the control. A higher wound closure was observed with ADPM2S2 hydrogel compared to the control at day14. A significant improvement in wound closure was observed with insulin loaded ADPM2S2 compared to the insulin alone treatment.

DIVISION OF DENTAL PRODUCTS

Aim of division is to develop and translate innovative

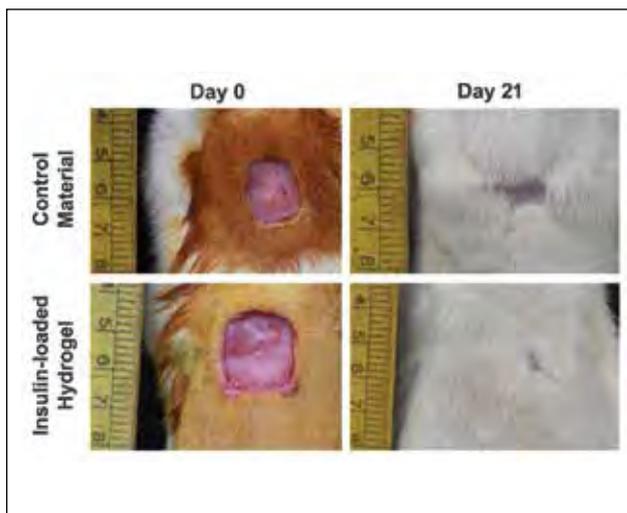


Figure 23: In vivo wound healing effect of insulin loaded ADPM2S2 hydrogels in diabetic rat model. Full thickness wounds were created on streptozotocin induced diabetic Sprague Dawley rats and the rate of wound healing was analyzed at different time points. A commercial alginate wound dressing is used as the control. A higher wound closure was observed with ADPM2S2 hydrogel compared to the control at day14. A significant improvement in wound closure was observed with insulin loaded ADPM2S2 compared to the insulin alone treatment

and affordable dental healthcare technologies. Currently the laboratory is engaged in the development of nano and organically modified ceramic composites for dental/orthopedic applications, biodegradable micro-needles, cell encapsulated click gels as bioinks for 3D Bioprinting, modified GIC and polymer scaffolds for tissue engineering. Our Mission is to become an internationally recognized team in developing and translating affordable healthcare technologies for the prevention of life style diseases through dental care, training, education and innovative research.

Developmental activities

Osteogenic evaluation of electrospun Polycaprolactone – Zinc oxide nano-particle scaffold with injectable platelet rich fibrin for periodontal tissue regeneration – in Collaboration with Saveetha Dental College.

Efficacy Evaluation of 3D Bioprinted Liver Constructs Established from Niche Specific Bioink and Stem Cell Derived Hepatocyte Like Cells”, (SERB-CRG Scheme, Dr. Shiny Velayudhan as the Co-PI).

Development of plasticizer-free acrylic denture soft liners using nanogel additives (IYBA, DBT Project, PI: Dr Manju S).

Other ongoing activities are: (i) Development and in vitro cytotoxicity evaluation of membrane for periodontal regeneration, (ii) antimicrobial ZnO containing dental pit and fissure sealant, (iii) Shell Nacre containing bone cement and (iv) Shell nacre containing scaffold.

New initiatives

1. An MoU was signed with Central Manufacturing Technology Institute, (CMTI), Bangalore, to explore the possibilities of Scaling up the Fabrication of Drug loaded Dissolving Polymer Microneedles (PI: Dr. Shiny Velayudhan).
2. A project entitled “Development and Evaluation of Batch Production System for Making Micro-Needle Array Patches for Trans-Dermal Drug Delivery” submitted jointly by SCTIMST Trivandrum and CMTI Bangalore to DST has been recommended for funding. (PI: Dr. Shiny Velayudhan).

3. A MoU has been processed for the research collaboration with Saveetha Dental College and Hospitals, Chennai and SCTIMST.

Technology transfer activities

1. Liver specific bioinks: Bioinks are polymeric hydrogels that are used to construct living tissues/organs in 3D Bioprinter. We developed liver specific bioinks that could be used for printing functional liver. Aparra Technologies Private Limited has sent the Expression of Interest to take up the technology of Chitra GelMA Bioink.
2. 3D bioprinted liver construct: Functional liver constructs were printed to be used as an in vitro platform for drug screening. This functional miniature liver constructs responded to various concentrations of drug and aided in arriving at a non-toxic concentration of drugs. Aparra Technologies Private Limited has sent the Expression of Interest to take up the technology of Chitra 3D bioprinted liver construct for drug toxicity testing.
3. Chitra Acrylosorb infected secretion solidification system: The products (Respiratory Secretion Solidification Bags) were made with the technology transferred from the Lab by Romsons® in the name ‘CANI SORB’. 100 bags were received for field testing. These were distributed to nearby centres for feedback.
4. Nanogel modified Glass Ionomer Cement (RMGIC): Prime Dental Pvt. Ltd. showed interest in conventional GIC and RMGIC. Conducted two online meetings with Prime dental management along with Technology Business Division, SCTIMST. Prevest Denpro Limited, Jammu, also showed interest in GIC. Data is being generated for optimising the polyalkenoic acid formulations for the glass powder supplied by the Company.

Research programs

Shell nacre integrated biomaterials for bone defect management: The replacement and repair of bone defects and irregularities is a major challenge, particularly for the aged population. The limitations



with autografts, allografts, synthetic bone graft materials, reports of amputations, and repeated revision surgeries insisted on the dire need for an alternative biomaterial. Shell nacre is an emerging bone substitute. A processing method was developed to get shell nacre powder with both organic and inorganic constituent. Composite shell nacre PCL scaffold were fabricated by thermal induced phase separation method and characterized. Shell nacre scaffolds were non-cytotoxic, bioactive and osteogenic. Human mesenchymal stem cells of both older and younger donor survived in the scaffolds for 21 days and induced bone formation. Similarly, formulated in situ polymerizable shell nacre cement (SNC) with shell nacre powder, shell nacre containing siloxane methacrylate resin, and other additives with a working time of 1-3 mins and setting time of 3-6 mins. Physico-chemical studies proved that shell nacre cement is bioactive, radiopaque, and exhibited compressive strength of more than 100 MPa. Further acute systemic toxicity test, animal intracutaneous reactivity test, and pyrogenicity test based on ISO 10993-10, 11 revealed the biocompatible nature of the shell nacre cement. Osseointegration of the in situ setting shell nacre cement was studied in a 2mm cortical defect surgery in the midshaft of the femur of Sprague Dawley rats for 6 and 12 weeks. Thus, shell nacre cement and shell nacre scaffolds are developed which would be promising candidates for managing both critical sized and irregular bone defects.

Osteogenesis of shell nacre integrated composite material with hBM-MSC of geriatric patients: Shell nacre integrated biomaterials are the promising candidates for bone defect management. However, the old age bone marrow mesenchymal stem cells have reduced osteogenesis, increased adipogenesis and the bone micro-environment is altered during aging. As the geriatric population undergo a high number of orthopaedic surgeries, it is crucial to evaluate any biomaterial with old age BM-MSCs to determine the real osteogenic potential, simulating the clinical situations. This study investigated the osteogenic potential of shell nacre cement (SNC) and scaffolds (SN-15 and SN-150) with elderly BM-MSCS. SNC, SN-15 and SN-150 were non-cytotoxic with human BM-MSCs, as confirmed by the direct and

indirect cytotoxicity studies. The colony forming unit -fibroblast (CFU-F) assay and senescent associated galactosidase (SA - gal) assay confirmed the reduced proliferation potential and senescence of elderly BM-MSCs than young BM-MSCs. Confocal imaging of the live cell tracker green stained cells confirmed the survival of both BM-MSCs over the materials up to 21 days. Scanning electron microscopy (SEM) with energy dispersive spectroscopy (EDS) revealed the hydroxyapatite mineralization of both young and elderly BM-MSCs. Furthermore, quantitative polymerase chain reaction (QPCR) analysis demonstrated that the SNC, SN-15 and SN-150 induced osteogenesis and angiogenesis of elderly BM-MSCs leading to an improved microenvironment for bone healing. Overall, this study suggested that shell nacre integrated cement and scaffolds are osteogenic and angiogenic and will be a potential candidate for managing bone defects in the near future.

Development of tissue specific bioinks: Liver specific bioinks with incorporation of liver ECM were developed and liver construct printed. The liver ECM was isolated, analysed and the soluble and insoluble was quantified. A novel formulation with liver ECM was developed and liver constructed were bioprinted using primary rat hepatocytes. The bioprinted liver constructs were implanted in rat models to ensure the biocompatibility.

Rapidly dissolving polymeric microneedles for delivery of analgesics: Rapidly dissolving polymeric microneedles were developed from novel polymer formulations. The aim was to develop a drug delivery platform for delivery of analgesics. The novel formulation enabled incorporating hydrophobic and lipophilic drugs into hydrophilic polymer matrix. The formulation also aided in improving the bioavailability of these drugs.

Plasticizer-free acrylic denture soft liners using nanogel additives: Soft liners have been widely used in dentistry as it forms a cushioned layer between the hard denture base and the oral mucosa and have the potential of improving comfort to patients with ridge atrophy, thin and non-resilient mucosa, bony undercuts and bruxomania. They are also recommended in the cases of irregular bone resorption, immediate prosthesis, healing after implant placement, and for patients with xerostomia. However, one of the major concerns is



the use of high concentrations of plasticizers in acrylic denture soft liners, especially phthalate esters. The plasticizer migration from these polymer networks can cause changes in mechanical properties of soft liners and compromise elasticity. Because of these characteristics acrylic soft-liners are used only for a short period of time. The present study focused on the development of acrylic denture soft liner formulation using nanogel additives without incorporating any small molecule plasticizer such as phthalate esters.

Glass Ionomer Cement for improving the mechanical properties: Glass ionomer cement (GIC) is a biocompatible dental restorative material formed by an acid-base setting reaction. The study aims to improve the mechanical properties of GIC using nanogel additives without compromising its biocompatibility.

Mucoadhesive bandages for oral drug delivery: Multiple gel formulations for the treatment of various oral disease conditions are available in the market. However, the retention of these drugs in the target gingival region is challenging as those common gel formulations can be easily wiped down from the oral moist environment by food, liquids and even saliva. There is a massive need for formulations that can enhance the retention of drugs in the target gingival region. The study aims to develop mucoadhesive bandages for multiple oral disease such as ulcers, leucoplakia, pain after surgery perforations etc.

Testing and evaluation

Testing facilities in the division was extended to the external and internal customers. Micro CT analysis, DLS Particle size analysis, and compressive strength testing of samples including internal and external were completed/ test report issued.

Training/outreach programs

Dr. Shiny Velayudhan attended 5 days' workshop on Integrated Scientific Project Management for Women Scientists and Technologists; Centre for Organization Development, Hyderabad, sponsored by DST, Govt. of India.

Academic Collaboration: The lab established a collaborative work with University of Leeds. Ms. Bridget (PhD Student of Dr. Lizymol), worked in the

lab of Prof. Elena Jones, Leeds Institute of Rheumatic and Musculoskeletal Medicine, for the studies of the scaffold and bone cement materials developed in SCTIMST, using human bone marrow mesenchymal stem cells cultures.

Other significant achievements

Dr. Shiny Velaydhan won the Best Oral Presentation Award (Scientist Category) at 35th Kerala Science Congress held at Mar Baselios Christian College of Engineering and Technology, Kuttikkanam, Idukki during 12 - 14 February 2023, for the paper entitled "Design and Development of Transdermal Drug Delivery Device for Painless Administration of Insulin".

Staff

Faculty

Dr Harikrishna Varma, Scientist G, Senior Grade
Dr Manoj Komath, Scientist G & Head of the Department
Dr Jayasree RS, Scientist G
Dr Lizymol PP, Scientist G
Dr Rekha MR, Scientist G
Dr Shiny Velayudhan, Scientist E
Dr Manju S, Scientist E
Dr Francis Fernandez, Scientist C

Technical

Dr Sureshbabu S, Scientific Officer - Instruments
Dr Nishad KV, Scientific Assistant (Instruments)
Ms Sreekala Balan P, Technical Assistant (Lab)-B
Mr Sajin Raj RG, Technical Assistant (Instruments) - B
Dr Deepu DR, Technical Assistant (Instruments)
Dr Remya KR, Technical Assistant (Instruments) - A
Mr Jijo PT, Technical Assistant (Instruments) - A



DEPARTMENT OF MEDICAL DEVICE ENGINEERING

The department focuses on the research and development of medical devices, covering the entire life cycle from conceptualization to technology transfer, including empirical design, computer aided modelling, in-silico evaluation, fabrication, prototyping and functional evaluation. The department has five divisions, four of which established their own domains of medical devices development; while the fifth division strongly supports the device development activities in precision fabrication of prototype devices. The five divisions are: (I) Division of Artificial Internal Organs; (II) Division of Extracorporeal Devices; (III) Division of Medical Instrumentation; (IV) Division of Polymeric Medical Devices and (V) Division of Precision Fabrication.

Apart from the above functions, the department extends support services to other internal divisions and external customers, like Regulatory affairs, Rapid Prototyping, Ethylene Oxide Sterilization, Package Validation, Material Characterization and Computer Aided Design and Analysis.

DIVISION OF ARTIFICIAL INTERNAL ORGANS

The division is executing R&D projects aimed at development of high-risk medical devices. This division has its core competence in the areas of design, prototyping, in vitro evaluation, process development and technology documentation for medical devices. We are also working in new areas like Orthotics & Rehabilitation, Orthopaedics and in vitro diagnostics.



Figure 24: Titanium Nitride (TiN) coated surface of coronary stent

Developmental activities

TiN-coated coronary stent: Proof of concept (POC) animal studies of TiN coated coronary stent is ongoing. Third TiN coated coronary stent was implanted in porcine animal model during 2022.

Spinal fixation system for thoracolumbar stabilization: The fixation system is high risk medical implant used to treat spinal deformity, fracture, tumor, and degenerative conditions. The aim of this project is to develop screw, connectors, rod, locking cap for these clinical conditions. The project is at in-vitro testing phase.

Cavity conformable self-retaining stent retractor Design and Proof-of-Concept: Retractors are used for optimum exposure to the operating site during surgery. The existing retractors are bulky and have reported incidents of retractor induced complications. The proposed design overcomes those limitations. The retractor was tested and ready for Technology transfer.



Figure 25: Metal prototype of Cavity Conformable retractor

Development of Pedicle Screw-Based Dynamic Stabilization Systems for degenerative diseases of lumbosacral spine: Dynamic stabilization system is high risk implant system for various spine disease conditions. It has assembly comparable to spinal fixation system with semi rigid rod that allows

movements much like natural spine. The project is in the concept phase.

Programmable Hydrocephalus Shunt: The hydrocephalus shunt is a device which so that the excess cerebrospinal fluid drain through the catheters via a pressure valve which opens at a minimum intra cranial pressure to other body cavities. The Shunt valve diaphragm was made for 1:1 scale which was subjected to Pressure Flow testing. The test results were compared with the analytical results. The patent was applied for the concept involving the diaphragm with the opening pressure adjustment mechanism.

Annuloplasty ring: The device was implanted in 3 test animals. All animals completed the evaluation period without any adverse events and the animals were then sacrificed and vital organs were sent for histopathology analysis.

Bioprosthetic Heart Valve: Durability studies have been completed on both 27 sized and 23 sized valves. Performance characterisation (hydrodynamic evaluation including steady flow test and back flow test), prior to and after the durability studies also showed good results. Pilot production of 23 sized valves was done and 2 valves have been implanted in animals. Animals implanted with the valves remain healthy and have not reported any adverse events.

Fontan Surgical Planning: The purpose of this study is to develop a methodology for the prediction of passage which has low energy loss using CFD based on the vascular structure of the patient, for bidirectional Glenn procedures, as well as the various types of completion Fontan operations. Patient specific 3-D vascular model will be taken using MRI scanning. The project was completed with limited number of patients and will be extended to bigger population.

fNIRS bases Brain Computer Interface: Research was continued using Functional Near Infrared Spectroscopy (fNIRS) to classify the brain state into rest, left motor active or right motor active states using deep learning techniques via a TDF project. These techniques were explored to form a BCI and the real-time classification accuracy obtained varied from

50% to 90% across different classes. Further research is required to increase the real-time classification accuracy to more than 95% including obtaining more data for training.

N-Terminal ProBNP (NT-proBNP) device: This device is designed to measure quantitative levels (100 -10000 pg/mL) of NT-proBNP from blood samples. The fluorescence based technology was coupled in immunoassay for the quantifications. Currently, minimum viable prototype (MVP) of NT-proBNP for heart failure diagnosis was under clinical validations.



Figure 26: Instrument for measuring NT-proBNP

Development of high strength cast Ti6Al4V for orthopaedic implants: Developed a design for a 2-level anterior cervical plating system comprising (i) a lean cervical plate below 1.7mm thickness based on the average vertebral measurements of the Indian population with the ventral side of the plate featuring tapered stubs at the far end of the holes for better bone grasp, (ii) variable angle screws permitting angulation up to ± 15 and (iii) self-locking clip arrestors for preventing screw loosening and backout.





Figure 27: The 2-level cervical plating system.

Orthotics and rehabilitation: Multiple programs of offloading devices, knee brace, prosthetic feet etc. are being initiated with funding from DST, Govt. of India and industries such as TYNOR, FUPRO and TATA Steel.

Development of Pedicle Screw-Based Dynamic Stabilisation Systems for degenerative diseases of lumbosacral spine: Dynamic stabilization system is high risk implant system for various spine disease conditions. The project is supported by DST, Govt. of India.

Technology transfer activities

Aortic Stent Graft – TRC: The device and delivery system performance has been demonstrated in vitro. A delegation from a leading medical device industry visited AIO to understand the Aortic Stent Graft technology and finalize an MOU for technology transfer. The device and delivery system were demonstrated to the visiting team. The stent material (NiTi alloy) processing is provided by the Materials Science Division of CSIR-NAL, Bengaluru.

Flow Diverter Stent and ASD Occluder - TRC: In vitro testing of Flow Diverter and ASD occluder device and delivery system samples fabricated by M/s Biorad, the industrial partner to whom the technology was transferred, has been initiated at AIO. Staff from M/s Biorad, Pune is deputed to AIO for same.

Research programs

Sepsis Rapid diagnostic test kit: Immunochromatography assay (ICA) is commonly used for the detection of biomarkers. In this program, the aim is to develop a device for semi quantitative kit which will be helpful in sepsis diagnosis. The project is in the process design stage.

Chlamydia trachomatis rapid diagnostic test kit: Chlamydia trachomatis is an obligate intracellular parasite with elementary bodies as its infectious stage. The objective of this project is to develop an antigen detection platform using the immunochromatographic method to detect chlamydia as a point of care test. Both these projects for test kits are co-development programs between SCTIMST and M/s. Biogeniex. Inc, Lucknow.

Diabetic foot ulcer offloading device: Bio-inspired total foot pressure off-loading device for diabetic foot ulcer management in geriatric population. Intended for offloading diabetic foot ulcer.

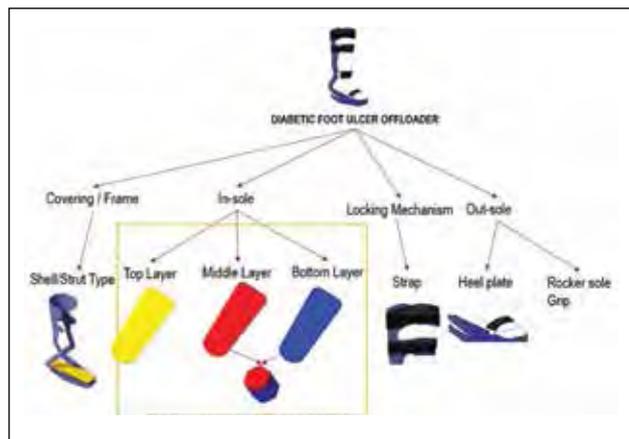


Figure 28: Component level design of Bio-inspired total foot pressure off-loading device

Development of stance control knee ankle foot orthosis (SCKAFO) for knee instability management: KAFO(knee ankle foot orthosis) users have abnormal gait patterns to compensate for the knee motion constraints imposed by the brace, which may lead to soft tissue injury, joint dysfunction, and reduced range of motion. Intended for patients with knee weakness



and instability. Stance control knee ankle foot orthosis (SCKAFO) allow free knee motion in swing phase while providing knee support in stance phase.



Figure 29 : Concept model of the stance control device for KAFO

Er. Arvind Kumar Prajapati was selected among top 5 Indian Young Scientist under Biomedicine theme in the 7th BRICS Young Scientist Conclave, 2022. As a part of Indian delegation, he presented “Transforming Healthcare through Technology Development” on 30 August 2022 where he highlighted SCTIMST ecosystem for the development of high-risk medical devices to the high-level delegations from BRICS Nations.

DIVISION OF EXTRACORPOREAL DEVICES

The Division is engaged with the research and development of extracorporeal life support medical devices mainly focusing on the cardiopulmonary system. The major ongoing activities in the Division include developing Left ventricular assist device, implantable infusion pumps, membrane oxygenators, cerebral micro-dialysis device, transcutaneous energy transfer system. The Division also supports various

projects of the Institute for rapid prototyping as well as for sterilization requirements.

Scientist (Regulatory affairs) of the division supports the research teams and industrial partners of the institute for a range of regulatory activities. The faculty is also taking part in the Materiovigilance Programme of India (coordinated by Indian Pharmacopeia Commission, Ghaziabad) monthly partners meeting as an expert member for providing the technical support in the causality assessment of medical device adverse events reported by the manufacturers and other healthcare professionals across the country.

The services of Ethylene oxide sterilization and Rapid prototyping were extended to other Departments and Divisions of the institute as part of various research and development programs.

Developmental activities

Implantable Micro Infusion Pump: In this project, an implantable device for intrathecal delivering the drugs such as Baclofen/Morphine/ to targeted portions of the body is being developed. Proof of concept is established with in vitro and in vivo experiments. The wireless charging to recharge the implanted battery is established. Multiple prototypes were developed and tested the performance reproducibility. Design change for reducing the thickness of the pump is in progress.



Figure 30: Implantable Micro Infusion Pump prototype



Development of Cerebral Micro dialysis device: Under the project titled “Design and development of micro dialysis set-up for cerebral applications” BDTD programme of DST, multiple prototypes were fabricated and tested. More than 60% recovery is achieved for the glucose transport at the current process parameters. A miniature pump was developed with low flow rates discharge capacity to use along with the probe. Testing of the pump is in progress.

Automatic Contrast Agent Injector: Development of a semi-automatic angiography system for facilitating coronary angiography and angioplasty” which can deliver precise amount of contrast to the blood vessel automatically for medical imaging is completed. The device consists of a disposable flow divider manifold and a portable hand held actuator as shown in the figure. Two prototypes of the device were fabricated. Invitro testing of the device is performed on a mock test loop to mimic the systemic circulation. A flowrate of 3ml/sec was achieved. The device was tested with different systemic pressure and flow rates to mimic the clinical conditions.

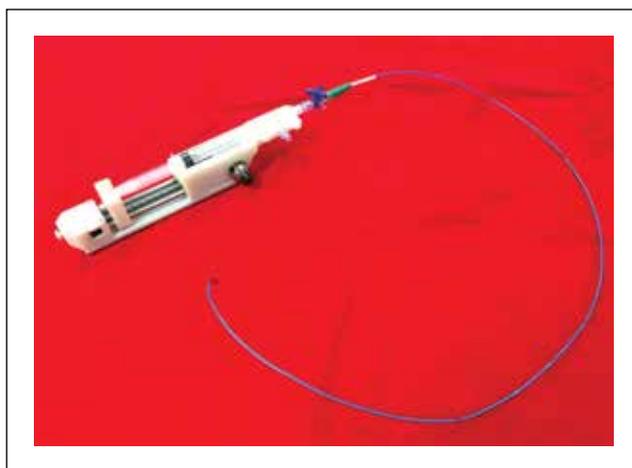


Figure 31: Automatic Contrast Agent Injector for coronary angiography and angioplasty

Development of Male Urinary Incontinence Device: An Industry funded collaborative project between M/s Abhaya 3CD Private Ltd, Chennai and SCTIMST to deliver technical support in regulatory and biological evaluation for developing male Urinary Incontinence Device. The device is a non-sterile, externally worn,

urine drainage device intended to be worn over the penis of an incontinent male patient to channel urine, via a tube, into a collection bag. It consists of a special holding mechanism & provide urine collection in a specially designed absorbent insert. MoU was signed on 5th July 2022. Test Manufacturing License from Central Drugs Standard Control Organization (CDSCO) for conducting necessary product testing and evaluations were obtained. Biological evaluation studies and mechanical characterization studies are progressing in SCTIMST and TTK Healthcare Ltd. Investigators from SCTIMST include: Ms Amrutha C, Scientist C (PI) and Dr. Roy Joseph, Scientist G (Co.PI).

New initiatives

An extramural project “Design and development of an organ care system for transplantation, ICMR Adhoc project” was approved by ICMR, with a budget 96.59 lakhs. Investigators are Vinodkumar V, Sarath S Nair, Nagesh D S, Sachin J Shenoy.

An extramural project “Point of care blood coagulation analyzer: Development and limited clinical validation” was approved in DST-TDP Programme, with a budget 32.688 Lakhs. Investigators are Anugya Bhatt, Sarath S Nair, Harikrishnan S

A service is initiated for providing necessary regulatory affairs services for external customers (like start-up companies, manufacturers etc.) to enable them to apply for product licensing and approvals from CDSCO.

Technology transfer activities

Initial Testing of the sub-systems of Infant Warming Wrapper and Infant Warming Bassinet prototypes developed by Keltron was evaluated as part of post Technology Transfer.

Multiple meetings were held with Meril Life Sciences to review of progress of scale up of Left Ventricular Assist Device (LVAD). Multiple prototypes of LVAD motor, controller, battery pack, batteries were fabricated.



Research programs

Development of Transcutaneous Energy Transfer System: Research on developing Transcutaneous Energy Transfer System for powering implantable medical devices such as LVAD, TAH and Implantable infusion pumps is in progress. A new method for automatic control of the system for dynamic loading and position conditions were explored. Hypothesis was proved with invitro tests. Prototypes of the device was fabricated and the performance of the system was verified with various invitro studies.

Left Ventricular Assist Device (LVAD) with TETS) for Destination Therapy: Ventricular Assist Devices (VADs) are circulatory support devices that help to maintain a nominal cardiac output for various physiological functions of the human body, in end stage cardiac failure patients. LVADs available now has a percutaneous cable to power the device from external battery packs. The major failure mode of these LVADs were the infection through the percutaneous connection. To avoid the failure mode a transcutaneous powering of the LVAD is explored. Also, the research aims to perfect the LVAD design for long term destination therapy for patients with end stage heart failure.

Total Artificial Heart: Various concepts for development of Total Artificial Heart is being explored. Design feasibility analysis initiated. Prior art search and literature survey is in progress.

Percutaneous LVAD: Discussions with clinicians are initiated to develop a miniature catheter based percutaneous Ventricular Assist Device for immediate use in emergency recovery of the patients with end stage heart failure. Prior art search and literature survey in progress.

Achievements

Sarath S Nair received the Best Biomedical Technology Innovation Award 2022 at the 38th batch Convocation held at 21-05-2022 at SCTIMST.

Er. Amrutha C, Scientist (Medical Device Regulation Nominated as a member of Impartiality Committee

Constituted by Indian Pharmacopeia Commission to review the certification activity of IPC as a notified body under Indian certification for Medical Devices (ICMED) Scheme jointly launched by Quality Council of India (QCI) and Association of Medical Device (AIMED) during March 2023.

DIVISION OF MEDICAL INSTRUMENTATION

Division of Medical Instrumentation is equipped with advanced facilities required for research and development in medical instrumentation and its activities include technology development for active medical implants, transducers and bio-electrodes, development of bio-electrical impedance measurement techniques and novel diagnostic tools such as those required for artefact free monitoring of breathing and early detection of various disorders. Currently the division's core research focuses on the development of active implants like Deep brain stimulators, Cardiac Defibrillators, Spinal cord Stimulators etc and various kinds of sensors and electrodes such as Subdural and depth electrodes along with electrochemical characterisation and bio-impedance techniques.

Developmental activities

Deep Brain Stimulator: Deep brain stimulator is a neuro prosthetic device for treatment of movement disorders such as Essential tremor, Parkinson's disease, Dystonia. Design of the device was frozen and multiple prototypes were fabricated. Five prototypes have been evaluated based on the ISO 14708-3 standard. Lead body flexion, atmospheric pressure withstand test, corrosion test has been performed. Charge characterisation studies for the electrodes were completed.

Implantable Cardioverter Defibrillator: A collaborative project with M/s Shree Pacetronix Limited on development of an Implantable Cardioverter Defibrillator (ICD) is in progress. The high voltage defibrillation circuit to provide a biphasic waveform using H Bridge circuit has been developed. A test setup for the evaluation of charging circuit was prepared. Promising results was obtained with a defibrillation voltage of 800V within 8 seconds. The controller for defibrillation circuit is under development.





Figure 32: Experimental setup for the evaluation of charging circuit

Automated External Defibrillator: Automated external defibrillator is a medical device used to prevent sudden cardiac death. Initial design of the device was completed. An algorithm for automated detection of arrhythmia condition and decision for shocking was developed. Bench top testing was performed to analyse the charging characteristics. Charging of capacitor to 1500V within 18 seconds for defibrillation was obtained. Final system assembly and integration of sub systems are in progress.

New initiatives

1. **Direct nerve stimulation using wireless power transfer technology:** Direct stimulation of nerves through wireless technology is an emerging technology in active implantable medical devices area. Using this technology, the implantable device can be powered directly eliminating the requirement of a battery. This technology could address the constraints associated with conventional implantable grade battery like size, cost, battery lifetime issues, reliability etc.
2. **Electrochemical corrosion setup:** An electrochemical corrosion system was made functional to conduct electrochemical experiments in bio-sensing, bio-detection, bio-impedance measurements, voltammetry studies etc.

Technology transfer activities

Follow up activities after the technology transfer of EPCE (External Pneumatic Compression Equipment) for Deep Vein Thrombosis Prophylaxis with M/s

Enproducts Ltd, Kochi was conducted on monthly basis. Visits were conducted to their manufacturing facility to discuss on the progress and hurdles. In vitro testing were done on the five prototypes fabricated by M/s Enproducts Ltd.

Research programs

Design and development of steerable electrodes with feedback for deep brain stimulator applications: A novel hybrid electrode for sensing and stimulation has been designed and developed. As part of the invitro testing, electro chemical characterisation is completed. Implantation studies for biocompatibility in neural tissues is in progress.

Achievements

Er. Jithin Krishnan served as a member of judging panel in IDEX 2022 (Indian Defence Expo) conducted by ministry of defence on 11/04/2022.

DIVISION OF POLYMERIC MEDICAL DEVICES

The Division of Polymeric Medical Devices focuses on the development of new polymers, polymeric formulations, composites and devices suitable for different biomedical applications. The lab is equipped with facilities for compounding/mixing, moulding, electrospinning, and parylene coating on medical devices. The lab is also equipped with static testing and dynamic mechanical analysis of polymeric materials. Facilities for polymer synthesis are also in place. This year, an Industry funded project, sponsored by Tata Steel Limited, was started in the Division.

Developmental activities

Orthotic Wrist support device from short coir fibre reinforced polylactic acid biocomposites. (Project funded by Tata Steel Limited): Management of medical plastic waste is a technological as well as an emerging pressing environmental concern. Biodegradable plastics offers a promising solution for the safe disposal of single use medical plastics at their end of life. However, the mechanical properties of most biodegradable plastics are not in par with that of conventional engineering plastics. A breakthrough technology is to improve the mechanical properties



of biodegradable plastics by using natural fibres as reinforcing elements. A scalable method for the production of short coir fibre is developed. Effect of fibre length and fibre loading on the tensile and flexural properties of the composite material is investigated. Our results show that coir fibre reinforcements result in twofold improvement in tensile stress of the composite materials and the mechanical properties are in par with Engineering plastics used in orthotics wrist support application.

Research programs

Universal airway device for isolation and selective ventilation of one lung: The universal airway device is a single lumen endotracheal tube (ETT) incorporating a left ventilating eye that can be used along with a bronchial blocker for isolation and selective ventilation of one lung. The device has the following advantages: i) Unlike the predicate double lumen tube, which is larger in size, the proposed device is a single lumen tube with modification and can be used even in patients with difficult airway ii) Unlike conventional single lumen tube with bronchial blocker, the proposed device prevents displacement of bronchial blocker, once the blocker has been securely positioned.

In vitro evaluation using human trachea model completed. In silico analysis (Ansys R18.2) was performed for visualizing the air flow during one lung ventilation using the device. Clinical evaluation to be undertaken with Industry collaboration.

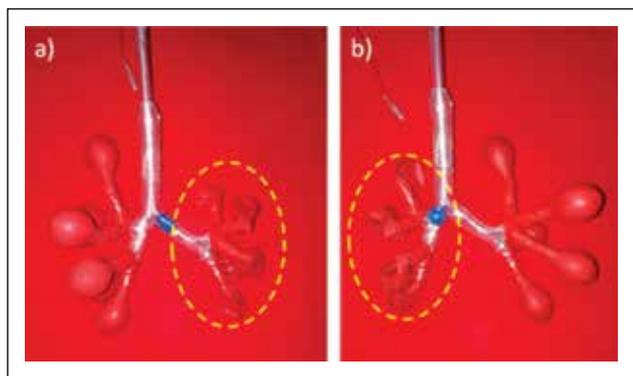


Figure 33: In vitro simulation of Universal Airway Device in a 3D printed adult trachea model a) Left lung collapse and right lung ventilation, b) Right lung collapse and left lung ventilation

Neuronal cell response on aligned fibro porous electro spun mat generated from silver ion complexed ethylene vinyl alcohol copolymer: Aligned electrospun mats were generated through complexing ethylene vinyl alcohol co-polymer with silver salts and the thus generated electrospun mats were of potential use as nerve guidance conduits or wraps. The fibroporous mats produced were subjected to physico-chemical characterization and biological studies to ensure their properties and to examine whether suitable for neuronal cell attachment and neurite extension. The results obtained from direct contact, MTT, and live/dead assay showed the cells are viable on the material. From the actin staining and immunostaining assays, it was evident that the PC12 cells could attach and extend their neurites in an aligned manner on the fibers. The maximum neurite extension was up to 200 μm in length.

Academic programs and participations

Summer training with scholarships for SC and ST students was started as part of their empowerment, was organised at BMT Wing program in April 2022. This was financially supported by the SEED division, Dept. of Science and Technology, Govt. of India. This was completed during the month of August 2022. Fifteen students belonging to Scheduled castes and 18 students belonging to Scheduled tribes completed their summer training sessions (duration 1 - 2 months) from SCTIMST. The educational backgrounds of the students were intermediate (+2), undergraduate and post graduate degrees in science and engineering disciplines.

Ms C S Dhanya, PhD scholar, Division of Polymeric Medical Devices, attended the Indo-US seminar on Recent Biochemical Approaches In Therapeutics (RBAT IX-2023) and presented a paper entitled, 'Effect of surface-charge of chitosan particles on intestinal epithelial tight junction opening for the transport of 5-fluorouracil' (Authors: C S Dhanya, M R Rekha and Roy Joseph). The seminar was organized by the Department of Biochemistry, University of Kerala & College of Nursing, University of Wisconsin, Milwaukee, USA from February 1-3, 2023, and held at the Dept. of Chemistry, University of Kerala, Trivandrum.



Dr Roy Joseph attended the In-house Training Course on Administrative Vigilance for Vigilance Officers held from October 19 - 21, 2022 at the Department of Science and Technology, Govt. of India, New Delhi.

Achievements

Dr Roy Joseph, Ms Gopika V Gopan and Dr Jayadevan E R received 11th National Petrochemicals Award from the Minister of State for Chemicals & Fertilizers and New & Renewable Energy, Shri. Bhagwanth Khuba for their invention, 'Metal-free radiopaque polymeric material for the embolization of arteriovenous malformation of brain' at a function held in Delhi on 27th September 2022.

Dr Gijo Raj was selected as Visiting Scholar at New York University Abu Dhabi, a School of New York University in United Arab Emirates (UAE) under the sponsorship of Prof. Pance Naumov, Prof. of Chemistry from 30/01/2023 to 12/02/2023. Dr Gijo Raj underwent training in the Operation of High Pressure High Temperature Quartz Crystal microbalance with Dissipation monitoring (HPHT QCMD). The equipment is one among the 5 equipment installed Word wide.

DIVISION OF PRECISION FABRICATION

This division provided the service support to other scientific/technical labs of the Institute in fabricating molds, dies, Jigs, fixtures and machining of prototype components related to various projects utilizing the CNC machines and conventional machines to deliver high precision fabrication and mold making work for the research programs of the Institute.

Developmental activities

Major support was provided for the TRC projects like Para corporeal Left Ventricular Assist Device, Bio prosthetic Heart Valve, Micro Infusion Pump, Intracranial Electrodes etc. From the Division of Precision Fabrication, nearly 69 work orders were executed (57 major work orders & 12 Minor work orders) and delivered to various projects during the year 2022-23, related to fabrication, machining of test setups and prototypes.

New Initiatives: Retrofitting of CNC Milling Machine and Lathe Machine initiated. Technical specification and Tender documents were prepared.

Some of the service activities carried out during 2022-23:



Figure 34 Dr. Roy Joseph, Dr. Jayadevan ER and Ms. Gopika V. Gopan receiving 11th National Petrochemicals Award

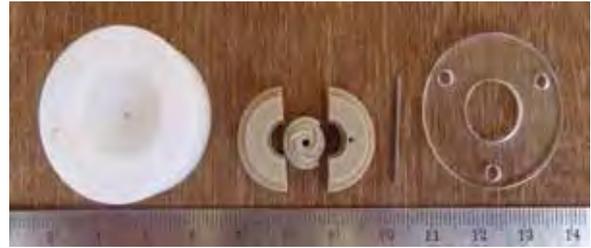




Wrench for Sternal Expander with SS screw.



Fixture for ACP Plate - Rigid body and sleeve



Test Device components for shunt



HCS Diaphragm Mould,



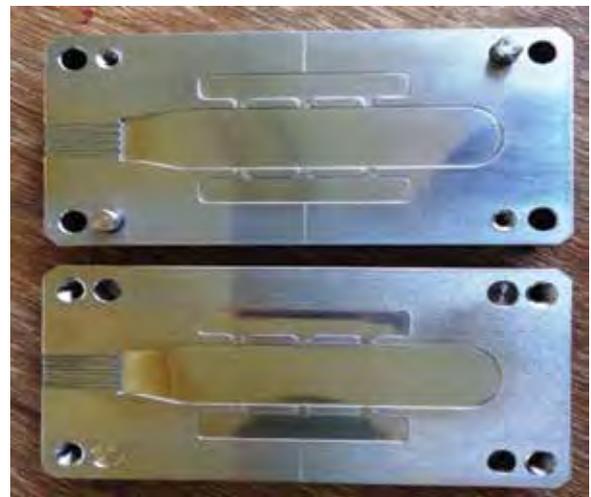
Micro dialysis mould



Ti Anterior Cervical Plates



Valve Holder Ø23



Contact Strip Mould

Figure 35 : Some of the advanced fabrication work done in the Division of Precision Fabrication



Brass Spacer



Valve stents



PC Connectors



Die and Punch heat treatment fixture



Heart Matrix along with cutting accessories



Aluminium Mould – Perfusion chamber



Mould for developing PDMS

Figure 36: Some of the advanced fabrication work done in the Division of Precision Fabrication

Staff

Faculty

Dr Ramesh P, Scientist G (Senior Grade) and Head of the Department

Mr Muraleedharan CV, Scientist G (Senior Grade)

Mr Nagesh DS, Scientist G (Senior Grade)

Dr Roy Joseph, Scientist G (Senior Grade)

Mr Ramesh Babu V, Engineer-G

Mr Vinodkumar V, Engineer G

Dr Sujesh Sreedharan, Engineer G

Mr Ranjith G, Engineer F

Mr Sarath S Nair, Engineer F

Dr Manoj G, Scientist E

Dr Sivakumar KGV, Engineer E

Mr Anoop Gopinathan, Engineer D

Mr Jithin Krishnan, Engineer C

Mr Subhash N N, Engineer C

Mr Arvind Kumar Prajapati, Engineer C

Mr Saurabh S Nair, Engineer C

Ms Amrutha C, Scientist C

Dr Gijo Raj, Scientist C

Dr Chhavi Gupta, Engineer C

Ms Neethu S, Engineer B

Technical

Mr Rajeev A, Sr. Scientific Assistant

Ms Jasmin Joseph, Scientific Assistant
Instruments

Mr Subhash Kumar M S, Technical Assistant - B

Ms Sreedevi V, Technical Assistant (Instruments) - B

Mr Biju Benjamin, Technical Assistant B –
Instruments

Mr Prathyush M, Foreman (Tool Room)

Mr Reji Kumar S, Technical Assistant (Machine
Operation) B

Dr Chandra Shekhar Nayak M, Technical Assistant
Instruments A

Mr Jiji Kumar R S, Technical Assistant- (Machine
Operation) A

Mr Vijesh S S, Jr. Tech. Assistant- (Machine
operation) A

Mr Sinulal M V, Technical Assistant- (Machine
operation) A



DEPARTMENT OF TECHNOLOGY AND QUALITY MANAGEMENT

Department of Technology and Quality Management (DTQM) co-ordinates and manages transfer of technology, Intellectual property management of various projects, management of quality system activities and accreditation (COFRAC, France for testing and NABL, India for calibrations), network/communication systems and engineering services in the BMT wing campus. Construction Wing organises major civil /construction activities for the campus. DTQM also includes central analytical facility for characterisation of medical devices and materials and an NABL accredited Calibration facility.

The following Divisions are included in the department:

(i) Calibration Cell; (ii) Central Analytical Facility; (iii) Engineering Services including - (iii a) Network services, (iii b) Electrical Maintenance, (iii c) Water supply, (iii d) Air-conditioning (MRAC), (iv) Technology Business Division including – (iv a) Intellectual Property Cell, (iv b) Customer Service Cell; (v) Quality Cell and (vi) Construction Wing

CALIBRATION CELL

Calibration Cell (CAC) is an in-house facility of SCTIMST for maintaining measurement traceability in accredited tests. Relevant calibration procedures at CAC are accredited by National Accreditation Board for Test and Calibrations (NABL). Measurement results are made traceable to the SI units either through calibrations or with the use of Reference Materials (RM). CAC also supports the testing labs in implementing quality control measures such as Inter-laboratory comparison and uncertainty estimation. CAC executes system validations for external customers on payment basis.

Developmental activities

Preparation and standardization of reference materials

for biological evaluations: The increasing demand for safe medical devices has led to the inevitable need for their preclinical biological evaluations. Traceability to international standards is a requirement of accreditation bodies for global acceptance of test reports and evaluation results. However, establishing traceability by accredited calibrations using reference standards cannot be achieved for biological evaluations based on ISO 10993 standards.

In such cases, use of reference material (RM) has become an essential tool. Indigenous development of ready to use RMs can assure the availability of RM in a cost-effective manner.

Dr S P Singh and Dr Nahar Singh, Senior Principal Scientists from CSIR-NPL visited SCTIMST during January 2023. Feasibility of bringing in house developed RM (Reference Materials) under the national umbrella of Bharatiya Nirdeshak Dravya (Indian Reference Material) programme of National Physical Laboratory (CSIR-NPL) was discussed during the visit.



Figure 37: Visit of NPL Team

Calibration services

Mechanical, thermal and electro-technical calibrations carried out by Calibration Cell are accredited by NABL, India as per ISO 17025:2017.

Mechanical calibration includes calibration of volumetric glassware, micropipettes, electronic



balances, mass sets and rotational speed. Calibration of Relative Humidity (RH) monitors, thermometers and temperature chambers like incubators are included in thermal calibrations. Total number of tests performed during the year 2022: Calibrations – 378, Surface profile Measurements – 34.

Training/outreach programs

- One Engineering graduate completed ‘DST-SCTIMST Summer Training 2022’ at Calibration Cell.
- Ms Leena Joseph was a resource person for a 2 day training programme given to industry on ‘ETO and Steam sterilizations’, organised by Institute Industry Partnership Cell (IIPC) of SCTIMST.
- Nine groups of engineering students visited Calibration facility during 2022.
- Two apprentice trainees completed skill training at Calibration Cell.

Achievements

Ms Leena Joseph served as a special Issue editor for ‘Mapan - Journal of Metrology Society of India’ (published by Springer Nature Switzerland).

Special Issue was on ‘Certified Reference Material for Scientific and Industrial Application’: Volume 37, issue 3, September 2022.

CENTRAL ANALYTICAL FACILITY

Central Analytical Facility (CAF) is the analytical service division of the BMT Wing equipped with facilities to carry out the physicochemical evaluation of biomaterials and biomedical devices. CAF offers analytical services to internal and as well as external customers. CAF is equipped with analytical instruments such as FT-IR spectrophotometer, UV-Visible spectrophotometer, Spectrofluorometer, Thermogravimetric analyzer, Differential scanning calorimeter, High-Performance Liquid Chromatograph, Gel permeation chromatograph, Gas Chromatograph, Confocal Raman microscope, Textural analyzer, Luminescent image analyzer, Universal Testing Machine, handheld XRF, Force

tensiometer, etc.

In addition to the test services offered to customers, the division supports various projects of the institute by providing technical advice and guidance wherever needed. It also undertakes study mode projects sponsored by external and internal customers for the physicochemical characterization of biomedical devices or materials in line with international standards. CAF assists M.Tech and Ph.D. students in their lab modules or internships. The division also organizes technical sessions and supports the academic activities of the institute by giving lab demonstrations to students, personnel from the industry, etc.

In CAF, the testing activities are carried out under the quality management system as per the guidelines of ISO 17025. The lab maintains quality, confidentiality, and impartiality in all of its testing activities. CAF is capable of performing most of the physicochemical analyses of materials outlined in the international standards for material evaluation. It is the only test service facility in Kerala accredited by the National Accreditation Board for Testing and Calibration Laboratories (NABL) for conducting residual ethylene oxide analysis of biomedical devices and materials. CAF also offers NABL-accredited test reports on the thermal analysis of materials. Those tests are compositional analysis using thermogravimetry, determination of glass transition temperature, and enthalpies of fusion and crystallization using differential scanning calorimetry.

Research programs

The research programs of the division mainly focus on the development of analytical methods and their validation. The development of biomaterials based on ionic liquids and exploring their biomedical applications is another research goal of the division. Ionic liquids are a versatile class of materials that are entirely composed of ions and have melting points lower than 100 °C. Their unique features including low vapor pressure, miscibility with a wide range of materials, good electrical conductivity, electrochemical stability, and wide liquidity range make them suitable for diverse applications. The presence of charged



centres enables them to function as antimicrobial agents. We have employed ionic liquids for the surface modification of conventional polymers to generate antimicrobial and wettable surfaces. Poly (ionic liquids) can be used to produce conducting flexible films/gels for multifunctional applications.

Testing and evaluation

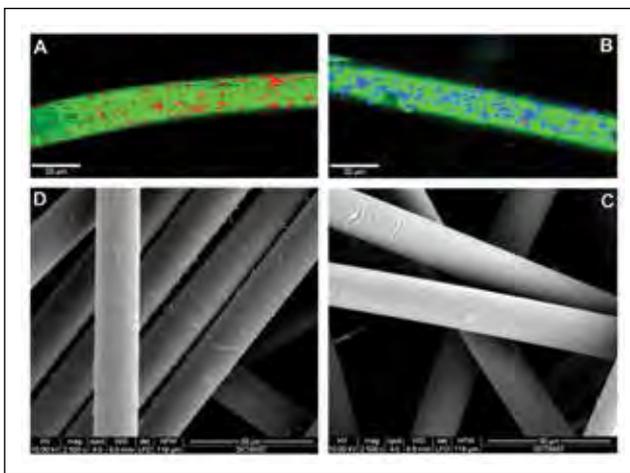


Figure 38: Raman and SEM imaging of bare and modified polymer showing bacterial adhesion. Raman images of A) bare fibre, and B) modified fibre. Green represents polymer, blue represents coating and red represents bacteria. SEM images of C) bare fibre and D) modified fibre.

During the year 2022-23, seven new tests including the tests of polymer films and personal protective equipment (PPE) were offered to the customers through the Customer Service Cell of the institute. These were: Tensile strength and elongation at break of PPE (EN 29073-3), Tear strength of PPE (Trapezoidal method-BS EN ISO 9073-4, ASTM D5733), Tear strength of fabrics (Single rip procedure-ASTM D2261), Synthetic blood penetration test of PPE (ASTM F1670), Water vapor transmission rate of PPE and fabrics (ASTM E96), Tensile strength and elongation at break of medical gloves (EN ISO 455-2, ASTM D6319) and Injectability and syringeability of gels using texture analyzer. During this period, about 1394 samples submitted by external and internal customers were analyzed at the CAF using various instruments available. NABL accreditation for performing three physicochemical tests was extended up to 03/01/2025 after an onsite assessment conducted

by the NABL team. The tests listed under NABL scope are: (a) Estimation of residual ethylene oxide (EtO) in EtO sterilized materials, (b) Compositional analysis of materials using Thermogravimetric analysis, and (c) Determination of glass transition temperature and enthalpies of fusion and crystallization of materials using differential scanning calorimetry.

During this period, four study projects were completed using the testing facilities available at CAF – (i) In vitro drug release studies : To estimate the release profile of curcumin/clotrimazole from drug-loaded acrylic soft liners; (ii) Development of SERS-based substrate for micro-Raman-based biosensors; (iii) Estimation of bisphenol-A (BPA) release from a newly introduced adhesive pre-coated flash-free bracket system - an in vitro study and (iv) Tensile analysis of autologous Platelet-rich fibrin (PRF) membranes.

Training/outreach programs

Staff of CAF attended a number of webinar lectures and training programs during this period. Details are as follows: (i) Dr. Renjith S., Ms. Nimi N., and Dr. Sasikala attended the I-STEM awareness program organized by Indian Science Technology and Engineering Facilities Map (I-STEM) and Indian Institute of Science (IISc) in a hybrid mode on 17 September 2022; (ii) All members of CAF trained to operate UV-Visible spectrometer (model: Evolution One Plus) and Portable handheld XRF installed in CAF during March 2023.

Participation in events

- Dr Renjith S, participated as a subject expert in a workshop organized by the State Council of Education Research and Training (SCERT), Government of Kerala to design and develop a curriculum for a state-level program to identify gifted students and develop their scientific skills entitled, “Nurturing Students Emerging Talents in Science (NuSETS)” on 26-27 July 2022.
- Mr Willi Paul delivered an invited lecture entitled, “Emerging applications of confocal Raman imaging in biomaterial research and medicine” during the international conference on biomaterials, regenerative medicine, and devices (Bio-Remedi 2022) held on 15th-18th December 2022 at IIT Guwahati, Assam.



- c) Dr. Renjith was involved in the organization of the National Conference on New Development in Polymeric Materials (DPM 2023) during 2-3 March 2023. The Society of Polymer Science India (SPSI) Thiruvananthapuram chapter organized the conference.
- d) Dr Renjith S. participated in the India International Trade Fare (IITF 2022), Pragathi Maidan New Delhi, from 14/11/2022 to 20/11/2022 and functioned as an exhibitor at the SCTIMST pavilion.

Faculty outreach

Dr Renjith S. (i) Interacted with the plus one and plus two students of Janatha HSS, Thempammood, and conducted a science quiz in association with the MRSI@school program organized by the Trivandrum chapter of MRSI on 10/11/22; (ii) Gave an oral presentation on “Ionic liquids for the antimicrobial surface modification of polymeric materials” during the international conference on biomaterials, regenerative medicine, and devices (Bio-Remedi 2022) held on 15th-18th December 2022 at IIT Guwahati, Assam; and (iii) Gave two lectures on “How material characterizations support the biological evaluation process?” and “Biological evaluation of medical devices – chemical characterization of materials – ISO 10993-18” on 09.01.23 in the workshop on “Biological safety & efficacy evaluation of medical devices” organized by the Industry Institute Partnership Cell, SCTIMST.

ENGINEERING SERVICES

Division is dedicated to deliver technical support for general maintenance of equipment and environment at various facilities, management of utility supply like network engineering, electrical power, water etc., maintenance of waste incinerator, and sewage systems of the campus. Electrical section maintains

- 11 kV supply substation system
- Transformer with total 2350 KVA capacity
- Diesel generator (total 1750 KVA)
- UPS system with total 400 KVA capacity for power backup.

During the reporting period, this division processed total 932 maintenance requests and 91 work orders. Specification development is completed for the

purchase of biomedical waste Incinerator as per Bio Medical Waste Management Rules 2016. The work is entrusted to CPWD.

Routine activities of Network Service Cell

- Computer and peripheral maintenance- Completed 530 maintenance work requests.
- Deployment of new computer/devices - Completed 34 requests.
- Software-As-A-Service requests -Completed 22 requests.
- Intranet user registration -Completed 46 requests.
- Bring Your Own Device (BYOD) registration -Completed 138 requests.

Developmental Activities

- Initiated procurement of Biomedical Incinerator
- Initiated establishment of 130 KW on-grid roof-top Solar photovoltaic plant through Solar City project.

Training/outreach programs

Conducted a workshop on “Development of Sustainable Waste Management Plan for BMT Wing” in connection with Swachhata Pakhwada celebrations on 18/5/2022.

TECHNOLOGY BUSINESS DIVISION

(Comprising of Customer Service Cell and Intellectual Property Rights Cell)

Technology Business Division focus on the following activities of the Institute:

- Institute industry interactions related to technology transfer and research project collaborations.
- Intellectual Property Rights like patent, design and trademark registration of the Institute.
- Testing services and specific protocol based study requests from the industry and academia for medical devices and biomaterials.
- Training, problem solving and consultancy activities of the Institute through the Industry Institute Partnership Cell
- Internal research project funding of the Institute comprising of the Technology Development Fund Scheme, internal review of the project application



and also interim status reviews of projects.

- Reports/questions for submission to external agencies such as DST, DSIR, ICMR, Loksabha/Rajyasabha etc. on the activities of Institute
- Outreach programs – giving exposure to students from different Institutions across India at the Institute and outside on development of medical devices
- Clinician discussions on the projects aimed / under development

Intellectual property generated

Title	Numbers
No: of Indian Patents Granted	32
No: of Indian patents Filed	25
No: of Foreign Patents Granted	2
No: of Foreign Patents Filed	1
No: of Design Registrations	17

The details are given in the tables in coming pages

Technology Transfer activities

Expression of Interest

Expression of Interest was invited for the following products during the year:

- In vitro diagnosis of HPV16/18 as an early marker for cervical cancer
- Universal airway device for isolation and selective ventilation of one lung
- 3D bio printed skin tissue constructs
- Portable low cost disposable defibrillator for cardiac arrest management

Technology transfer

- The license agreement with M/s Forsta Meditech Private Limited for the technology transfer of Automatic Smart Trash Bin for Disinfection Using UV Enabled Microwave (Astra) was signed on 23rd June 2022.
- The license agreement with M/s Onyx Medicals Pvt Ltd for the technology transfer of Drug Eluting Bioactive Calcium Sulfate Cement was signed on 13th September 2022.
- The license agreement with M/s Biorad Medisys Pvt Ltd for the technology transfer of liquid

embolic agent for application as a permanent implant occluding the abnormal blood vessels of the brain was signed on 3rd October 2022.

MoU /Collaborative product development

- An MoU was signed with M/s Phraction Scientifics Private Limited on 31st March 2022 for joint development of platelet concentrator and segregator.
- An MoU was signed with M/s Abhaya 3CD Private Limited on 5th July 2022 for a project which imparts technical support on the regulatory aspects for the male incontinence device developed by the company.
- An MoU was signed on 20th August 2022 with Central Manufacturing Technology Institute (CMTI), Bangalore for the development of scalable technology for fabrication of polymeric micro devices for biomedical applications.
- An MoU was signed on 16th August 2022 with Government Engineering college, Barton Hill, Thiruvananthapuram to promote co-operation in research and development in areas of mutual interest.
- MoU was signed on 30th August 2022 with IIT Kanpur for collaboration in academics, research and technology development
- MoU was signed with Christian Medical College (CMC) Vellore on 8th December 2022 for collaborative research in Evaluating the circulatory exosomes and exosomal miRNAs in Systemic Sclerosis patients for predicting disease progression/organ damage.

Non-Disclosure Agreement

1. Non-Disclosure Agreement signed with Post Graduate Institute of Medical Education and Research (PGIMER) for Testing of C1-2 artificial joint and research aspect.
2. Non Disclosure Agreement signed on 9th December 2022 with GESCO Healthcare Pvt Ltd for development of prototypes of neurosurgical devices.
3. Non Disclosure Agreement signed on 9th February 2023 with Anthra Pradesh Medtech Zone Ltd (AMTZ) for exploring possibility of collaboration / technology transfer.



PATENTS (INDIA) GRANTED (SEALED)

Sl. No	Ref No	Application Number	Date Of Filing	Patent Number	Date Of Grant	Title Of Invention	Inventors
01	IPEXP194.Y20	202041036226	22/08/2020	427997	31/03/2023	A process of preparation of an injectable hydrogel formulation of mammalian cholecyst extracellular matrix for tissue engineering applications	Pratheesh Kanakarajan Vijayakumari, Praveen Kunjan Sobhan, Thapasimuthu Vijayamma Anilkumar, Reshmi Raj, Purnima Chandramohanam
02	IPTR041.Y13	4867/ CHE/2013	29/10/2013	426017	21/03/2023	Porous Scaffold For Tissue Engineering	Prabha Damodaran Nair Neena Aloysious
03	IPTRU079.Y16	201641015636	05/05/2016	426700	24/03/2023	Biomimetic Fibrin Gel Composite Injectable To Spinal Cord Injury For Prevention Of Immune Reaction And Delivery Of Neural Progenitors	Lissy Kalliyana Krishnan Tara Sudhadevi
04	IPBST164.Y20 (TRC)	202041022745	30/05/2020	424961	14/03/2023	Hydro-nanogel powder formulation for oral protein delivery applications	Mannemcherril Ramesan Rekha
05	IPMPL054.Y14	3482/ CHE/2014	15/07/2014	423230	27/02/2023	A portable device and a method for non-contact warming of blood and intravenous fluids with infrared heating from refrigerator condition to physiological condition	Sarath sasidharan Nair Nagesh Divakara Panickar Sulochana



PATENTS (INDIA) GRANTED (SEALED)

Sl. No	Ref No	Application Number	Date Of Filing	Patent Number	Date Of Grant	Title Of Invention	Inventors
06	IPAIO102.Y17 (TRC)	201741039555	07/11/2017	422625	22/02/2023	A delivery device for positioning and deployment of stent grafts	Sujesh Sreedharan, Krishna Kumar Sreekumaran, Vivek Parayath Uthaman, Subhash Neyyattinkara Neelakandan
07	IPTER096.Y17	201741031416	05/09/2017	421123	10/02/2023	Pullulan-gelatin cross linked biodegradable cryogel scaffold as an implant for cartilage tissue repair	Nimi Nirmala Resmi Anand Merlin Rajesh Lal Lawrence Panchali
08	IPIMT027.Y12	4529/ CHE/2012	30/10/2012	420067	01/02/2023	Single step method for covalently linking heparin to decellularised tissue	Prabha Damodarannair Payanam Ramachandra Umashankar Prem Mohan Mohana Chandran
09	IPNES132.Y19	201941005030	08/02/2019	419844	31/01/2023	A multimodality stimulation device for neurological disorders	Sajith Sukumaran SeshSivadasan Sajithlal Madavan Krishnamma Jithin Krishnan Rajkrishna Rajan





PATENTS (INDIA) GRANTED (SEALED)									
Sl. No	Ref No	Application Number	Date Of Filing	Patent Number	Date Of Grant	Title Of Invention	Inventors		
10	IPMPL017.Y12 (TRC)	1080/CHE/2012	23/03/2012	419263	25/01/2023	A centrifugal pump for transferring fluid at a reduced priming volume without deterioration of inherent fluid properties.	Nagesh Divakara Panickar Sulochana Vinod Kumar Viswanathan Pillai		
11	IPDTL076.Y15	201641012862	12.04.2016	416460	02/01/2023	A process of ascertaining reliability and determining safe service life of high risk medical implants like artificial heart valves using an accelerated durability testing apparatus	Subhash Neyyattinkara Neelakandan.		
12	IPINL046.Y13	46/CHE/2014	06/01/2014	416465	02/01/2023	An external pneumatic compression device for prevention of deep vein thrombosis	Jithin Krishnan Koruthu Puthenparampil Varughese		
13	IPTRT115.Y18	201841018045	14/05/2018	416391	02/01/2023	A microfluidic paper based analytical device with a laminated base and the process of fabrication	Lynda Veluthetil Thomas Prabha Damodaran Nair Priyadarsini Sreenivasan		
14	IPMPL066.Y15	2918/CHE/2015	10/06/2015	415692	28/12/2022	An improved portable infant warming device having radiant non contact warming infrared light emitting diodes for providing a uniform warm environment around a premature born baby	Sarath sasidharan Nair Nagesh Divakara Panickar Sulochana		
15	IPPM136.Y19 (TRC)	201941013381	03/04/2019	415206	2.12.2022	A radiopaque polymeric liquid embolic system	Roy Joseph, Jayadevan Enakshy Rajan Gopika Valsalakumari Gopan		

PATENTS (INDIA) GRANTED (SEALED)

Sl. No	Ref No	Application Number	Date Of Filing	Patent Number	Date Of Grant	Title Of Invention	Inventors
16	IPEXP005.Y11	877/CHE/2012	08/03/2012	414227	12.12.2022	A simplified procedure for isolating tissue engineering scaffolds from small intestinal submucosa of warm blooded animals	Thapasimuthu Vijayamma Anilkumar
17	IPEXP035.Y13 (TRC)	2338/CHE/2013	29/05/2013	413604	05.12.2022	A procedure for fabricating xenograft using mammalian cholecyst derived extracellular matrix for wound healing applications	DeepaRevi, Thapasimuthu Vijayamma Anilkumar, Jaseer Muhamed Ceethakulath Jamaludheen
18	IPECD143.Y19	201941041135	11/10/2019	413329	01.12.2022	A suction retractor device for aortic valve replacement in adult cardiac surgery	Bineesh Kundoly Radhakrishnan, Sarath Gopalakrishnan, Vinodkumar Viswanathan Pillai, Rajkrishna Rajan
19	IPBPI058.Y14	4025/CHE/2014	18/08/2014	413196	30.11.2022	Detection And Removal Of Endosulfan From Gro Und Water Using Cadmium Selenium Quantum Dots	Jayasree Ramapurath Sarojini amma Lakshmi Vijayan Nair
20	IPEXP006.Y11	1176/CHE/2012	28/03/2012	413023	30.11.2022	A process for delaminating tissue layers of urinary bladder for isolating extracellular matrix components	Thapasimuthu Vijayamma Anilkumar





PATENTS (INDIA) GRANTED (SEALED)									
Sl. No	Ref No	Application Number	Date Of Filing	Patent Number	Date Of Grant	Title Of Invention	Inventors		
21	IPBCL069.Y15	4362/ CHE/2015	20.08.2015	412159	23.11.2022	New generation of calcium phosphate based bioceramic scaffolds from synthetic inorganic precursors and a process for the preparation thereof	Parimanathu Kovilakom Rama Varma Hari Krishna Varma, Nimmy Mohan, Sivadasan Suresh Babu		
22	IPDPL191.Y20	202041025478	17/06/2020	410827	02.11.2022	Low cost bioactive bone cements	Lizymol Philipose Pampadykandathil Bridget Jeyatha Wilson		
23	IPDEP093.Y17	201741025621	19/07/2017	410403	31.10.2022	Development of smart bioactive radiopaque dental composite with superior mechanical properties from inorganic-organic hybrid resin	Lizymol Philipose Pampadykandathil Kalliyanakrishnan Venkateswaran Vibha Chandrababu		
24	IPTRU070.Y15	4543/ CHE/2015	28/08/2015	407428	23.09.2022	Fibrin wafer for sustained local delivery of human albuminated curcumin	Lissy Kalliyana Krishnan, Ranjith Sankarankutty Kantha		
25	IPMPL074.Y15	5557/ CHE/2015	16/10/2015	409296	9.10.2022	An improved portable bassinet with controlled infrared warming facility for thermoregulation of low-birth-weight infants to achieve faster weight recovery and a method for the same	Sarath sasidharan Nair, Manoj Komath		

PATENTS (INDIA) GRANTED (SEALED)

Sl. No	Ref No	Application Number	Date Of Filing	Patent Number	Date Of Grant	Title Of Invention	Inventors
26	IPPMD124.Y18 (TRC)	201941001306	11/01/2019	404518	25/08/2022	Amino acid enriched tunable bioink formulation for multidimensional bioprinting and the process thereof	Roy Joseph, Praveen Kunjan Sobhan
27	IPINL067.Y15	3022/ CHE/2015	17/06/2015	402986	04/08/2022	Arterial compression device for post angioplasty management in femoral and radial puncture site	Jithin Krishnan, Muraleedharan Chirathody Vayalappil
28	IPDEP082.Y16	201641026539	03/08/2016	402649	29/07/2022	An antimicrobial wound dressing material	Kalliyanakrishnan Venkateswaran, Lissy Kalliayana Krishnan,
29	IPDEP118.Y18	201841028120	26/07/2018	400578	30/06/2022	A process for the synthesis of shell nacre containing bio-resin for dental and orthopedic applications	Rethikala Pandikapallil Kumaran Lizymol Philipose Pampadykandathil Wilson Bridget Jeyatha Venkiteswaran KalliayanaKrishnan
30	IPPMD135.Y19 (TRC)	201941013380	03/04/2019	398081	30/05/2022	A non-cytotoxic Diphenolic tetraiodo compound and method of preparation thereof	Roy Joseph, Gopika Valsalakumari Gopan
31	IPMPL008.Y11	114/CHE/2012	11/1/2012	394822	18/04/2022	An improved system for vapour polishing of plastic components in a metallic vessel	Nagesh Divakara Panickar Sulochana Vinod Kumar Viswanathan Pillai





PATENTS (INDIA) GRANTED (SEALED)							
Sl. No	Ref No	Application Number	Date Of Filing	Patent Number	Date Of Grant	Title Of Invention	Inventors
32	IPMPL057.Y14 Joint application with sidd life sciences Pvt Ltd	5365/ CHE/2014	28/10/2014	394363	06/04/2022	A spiral cross flow compact heat exchanger for blood to be provided with membrane oxygenators employed in extracorporeal cardiopulmonary support	Nagesh Divakara Panickar Sulochana Vinod Kumar Viswanathan Pillai Vijayakumar Harikrishnan

Patents (India) Filed					
Sl. No	Ref No	Application No	Date of Filing	Title of Invention	Inventors
01	IPDPL224.Y22 (DBT & SCTIMST)	202241019852	01.04.2022	Plasticizer free acrylic denture softliners	Manju Saraswathy, Anusree Vasu Shymalatha
02	IPAIO225.Y22	202241052131	13.09.2022	A pedicle screw assembly	Arvind Kumar Prajapati, Chirathodi Vylappil Muraleedharan, Harikrishna Varma Parimanathu Kovilakam Ramavarma, Krishnakumar Kesavapisharady, Akhil Anilkumar Indiradevi, Balram Babu Manoj Komath,
03	IPBCL226.Y22	202241043716	30.07.2022	Reactive mistgenerating system for obtaining nanostructured, multilayered and multiphase calcium phosphate coatings in plasma spray	Sajin Raj Rajan Girija, Suresh Babu Sivadasan, Harikrishna Varma Parimanathu Kovilakom Rama Varma

Patents (India) Filed					
Sl. No	Ref No	Application No	Date of Filing	Title of Invention	Inventors
04	IPBPL227.Y22 (Direct Complete spec filing)	202241045140	08.08.2022	A hand held electrically operated device for automatic delivery and refilling of contrast injector	Sarath Sasidharan Nair, Bijulal Sasidharan
05	IPDCE228.Y22	202241041968	22.07.2022	Portable Low-Cost Disposable Automatic Defibrillator For Cardiacarrest Management	Manikandan Sethuraman, Manoj Govinda Pillai Sulochana Amma, Rahul Gopinathanpillai Nath
06	IPAIO229.Y22	202241048796	26.08.2022	A fluid flow control device with flat type adjustable differential pressure valve	Anoop Gopinathan, Sukanya Latha Jayachandran, Vipin Dev Vasudevan, Jithu Raj Raju, Subhash Kumar Mahadevan Subhashmandiram, Chirathodi Vylappil Muraleedharan
07	IPMEI230.Y22 (TRC)	202241053990	21.09.2022	Digitally controlled multichannel neurostimulator for pain management	Jithin Krishnan, Neethu Sundarlal, Muraleedharan Chirathody Vayalappil, Nandu Krishnan A M, Ajay Prasad Hirishi
08	IPMEI231.Y22	202241052913	16.09.2022	Automated pressure challenge test system for chip based electronic devices	Jithin Krishnan, Neethu Sundarlal, Muraleedharan Chirathody Vayalappil, Adhil Aboobacker





Patents (India) Filed					
Sl. No	Ref No	Application No	Date of Filing	Title of Invention	Inventors
09	IPNES232.Y22 (SCTIMST & Govt Engg Coll. Barton Hill) (Direct Complete spec filing)	202241053714	20.09.2022	A rotating casket arrangement for positioning, turning and transferring of a human being	Smita V, Anish Karimannur John, Arun Anirudhan A, Rebin Zachria Mathew, P Harish Ram, R Rahul Dev, Abhiram V S, Suja R
10	IPLAS233.Y22	202241061704	29.10.2022	Mice transfer box-tunnel system with securing gates	Harikrishnan Vijayakumar Sreelatha, Arvind Kumar Prajapati
11	IPMEI234.Y22 (TRC) (Direct Complete spec filing)	202241060846	26.10.2022	A temperature profiling system with in-plane three axis movement for chip- based electronic devices	Jithin Krishnan, Muraleedharan Chirathody Vayalappil, Biju B
12	IPEXP235.Y22	202341003820	19.01.2023	A process for the fabrication of multilayered porcine cholecystic extracellular matrix (cecm) for tissue engineering applications	Thapasimuthu Vijayamma Anilkumar, Nebu George Thomas, Pratheesh Kanakarajan Vijayakumari, Yogesh Bharat Dalvi, Raveen Kunjan Sobhan, Nibu Varghese, U N Naga Lekshmi, Betsy Thomas

Patents (India) Filed					
Sl. No	Ref No	Application No	Date of Filing	Title of Invention	Inventors
13	IPTRT236.Y22	202241072828	16.12.2022	Three-dimensional hydrophilic nanofibrous membrane as tissue extender promoting neovascularization and a process of preparation thereof	Jayanand Sudhir Bhanu, Rakhi A, Prabha Damodaran Nair, Lynda Velutherilthomas, Sachin Jayachandra Shenoy, A Sabareeswaran
14	IPMEI237.Y22	202241072554	15.12.2022	An implantable multipolar hybrid electrode probe for neural stimulation and sensing	Jithin Krishnan, Syam K, Krishnakumar K, Muraleedharan Chirathody Vayalappil
15	IP TIC238.Y22 (TRC)	202341021496	25.03.2023	Three-dimensional bioprinted in vitro hepatotoxicity assay platform	Anilkumar Pallicka Veedu Rajan Asari, Shiny Velayudhan, Anupama Jayaprabha Sekar
16	IPNES239.Y22 (SCTIMST & Govt Engg Coll. Barton Hill) (Direct Complete spec filing)	202241071067	09.12.2022	Self retaining- non tapering endonasal speculum for endonasal endoscopic / microscopic surgeries	Sanjay Behari, Prakash Nair, Anish Karimannur John, Arun Anirudhan V, M Gowtham, Sanjay Hm, Rebin Zachria Mathew, P Harish Ram, R Rahul Dev, Abhiram V S, Basil Biju K, Sidharth A, Easwer Hv



Patents (India) Filed						
Sl. No	Ref No	Application No	Date of Filing	Title of Invention	Inventors	
17	IPDEP240.Y22	202241077522	31.12.2022	A process for the fabrication of low-cost polymeric composite osteogenic bone substitute / bone graft expander	Bridget Jeyatha Wilson, Lizymol Philipose Pampadykandathil	
18	IPDEP242.Y22 (SCTIMST & SERB)	202341003519	18.01.2023	Nanogel modified glass ionomer cement	Manju Saraswathy, Sreejith Sasidharan Lathikumari, Suresh Babu S	
19	IPNES243.Y22 (SCTIMST & Govt Engg Coll. Barton Hill) (Direct Complete spec filing)	202341002949	14/01/2023	An integrated suction and irrigation device	Prakash Nair, Anish Karimannur John, Easwer Hv, Sanjay Hm, M Gowtham, Rebin Zachria Mathew, P Harish Ram, R Rahul Dev, Abhiram V S, Basil Biju K, Abhishek Ap, Rehan Sumildhas, Arun Anirudhan V, Sanjay Behari	



Patents (India) Filed					
Sl. No	Ref No	Application No	Date of Filing	Title of Invention	Inventors
20	IPNES244.Y22 (SCTIMST & Govt Engg Coll. Barton Hill) (Direct Complete spec filing)	202341003363	17/01/2023	Adaptive patient trolley e-drive	Smita V, Anish Karimannur John, Subin Sukesan, Shrinivas V G, Prasanta Kumar Dash, Jayakrishnan C, Goutham Sai Krishna, A Arjun, Aparna Govind, Ayush Arun, Rajeev Rajan, Dinesh Gopinath, Sreelal S, Arun Anirudhan V
21	IPAIO245.Y22 (SCTIMST & ICMR)	202341007849	07/02/2023	Fluorescence-based lateral flow device for detection of n-terminal brain natriuretic peptide (nt-probnp) and the process thereof	Manoj Gopi, Harikrishnan Sivadasan Pillai, Anoop Kumar Thekkuveetil, Anugya Bhatt, Jeemon Panniyammakal, Sanjay Ganapathy, Vani Maya





Patents (India) Filed					
Sl. No	Ref No	Application No	Date of Filing	Title of Invention	Inventors
22	IPEXP246.Y22 SCTIMST & Govt Engg Coll. Barton Hill)	202341007709	07/02/2023	Tool for isofixing, isofixing of large size sheep/pig heart	Sabareeswaran A, Ranjith Gopinath, Sachin.j.shenoy, Sowmya Ramanan.v, Anish Karimannur John, Pharish Ram, Rebin Zachira Mathew, Smrithi Mk, R.rahul Dev, Abhiram.v.s, Ayush Arun, Aswanth S, Arun Anirudhan.v
23	IPNES247.Y23 SCTIMST & Govt Engg Coll. Barton Hill)	202341021144	24/03/2023	Universal magnetic instrument holder	Prakash Nair, Sajin Raj Rg, Anish Karimannur John, Easwer Hv, Dhanya S, Sanjay Hm, M Gowtham, Ayush Arun, Aswanth S, Ravin Jayakumar, Ananya L Nair, S Anandhu, Arun Anirudhan V, Sanjay Behari

Patents (India) Filed						
Sl. No	Ref No	Application No	Date of Filing	Title of Invention	Inventors	
24	IPNES248.Y23 SCTIMST & Govt Engg Coll. Barton Hill) (Direct Complete spec filing)	202341021145	24/03/2023	A surgical chair	Prakash Nair, Sajin Raj Rg, Anish Karimannur John, Easwer Hv, Dhanya S, Sanjay Hm, M Gowtham, Rebin Zachira Mathew, Aiswarya Mohan, Adith V S, Sreedarsh V, Arjun Sankar J M, Arun Anirudhan V, Sanjay Behari	
25	IPBCL249.Y23 (SCTIMST & ICMR, FILED THROUGH ICMR)	202311005516	27/01/2023	A self-gelling and self-setting bioactive cement formulation for dental tissue regeneration	Manoj Komath, Eva C Das	
	IPBCL249.Y23 (SCTIMST & ICMR, FILED THROUGH ICMR)	202311005516	27/01/2023	A self-gelling and self-setting bioactive cement formulation for dental tissue regeneration		



Patents (Foreign) Granted						
Sl No	Ref no	Patent no	Appl no	Title of invention	Inventors	Country
01	IPAIO123.Y18 (TRC)	2021/02576	2021/02576 (PCT/ IN2019/050936)	A self expanding flow diversion device with enhanced kink resistance and radial strength	Sujesh Sreedharan Anku Sreekumar Sreehari Unnikrishnan Nair	South Africa
02	IPAIO099.Y17 (TRC)	2020/03941	2020/03941 (PCT/ IN2018/050642)	Implantable atrial septal defect occlusion device with woven central section on left atrial flange	Sujesh Sreedharan, Jijo Jerard, Liji Geetha Vijayan, Bijulal Sasidharan	South Africa

Patent (Foreign) Applications Filed						
Sl No	Ref no	Appl no	Date of Filing	Title of invention	Inventors	Applicant
01	IPTRU179.Y20	17/925,385 PCT/ IN2021/050453	15.11.2022	A formulation of pure dimethoxy curcumin-human serum albumin and a process for the preparation thereof	Lissy Kalliyana Krishnan, Renjith Parameswaran Nair, Mejo Chirattaparambil Korah, Deepa Sathee	Institute Fund

Design Registrations (India)			
Sl. No	Ref no	Design no	Title of invention
01	IDAIO047.Y22	365502-001	Anterior cervical plate
02	IDMEI048.Y22 (TRC)	368048-001	Thermal curing mould pattern assembly for intra cranial electrodes

Inventors

Kelekanjeri ganapathi vishwanathan siva kumar, ajmal mohammed t, Muraleedharan chirathody vayalappil, Krishna kumar kesavapisharady, Ganesh divakar

Jithin krishnan, neethu sundaral, muraleedharan chirathody vayalappil



Design Registrations (India)					
Sl. No	Ref no	Design no	Date of Filing	Title of invention	Inventors
03	IDMEI049.Y22 (TRC)	368049-001	20.07.2022	Thermal curing mould pattern assembly for intermediate lead in implantable active medical device applications	Jithin krishnan, neethu sundarlal, muraleedharan chirathody vayalappil
04	IDMEI050.Y22	367751-001	15.07.2022	Automated external defibrillator	Neethu sundarlal, jithin krishnan, muraleedharan chirathody vayalappil
05	IDECD051.Y22 (SCTIMST & DST)	372688-001	17.10.2022	A joining module for a microdialysis probe	Chhavi gupta, vinodkumar viswanathan pillai, sarath sasidharan nair
06	IDNES052.Y22 (SCTIMST & Barton Hill Engg. Coll. TVM)	373038-001	25.10.2022	A rotating casket arrangement for positioning, turning and transferring of a human being	Smita v, anish karimannur john, arun anirudhan v, rebin zachria mathew, p harish ram, r rahul dev, abhiram v s, suja r
07	IDNES053.Y22 (SCTIMST & Barton Hill Engg. Coll. TVM)	374569-001	24.11.2022	Self retaining- non tapering endonasal speculum for endonasal endoscopic / microscopic surgeries	Prakash nair, anish k. John, easwer hv, sanjay hm, m gowtham, rebin zachria mathew, p harish ram, r rahul dev, abhiram v s, basil biju k, sidharth a, arun anirudhan v, sanjay behari
08	IDAIO054.Y22	374796-001	29.11.2022	Self-locking clip arrester for bone implants	Kelekanjeri ganapathi vishwanathan siva kumar, Vishnu s prasad, Muraleedharan chirathody vayalappil
09	IDEXP055.Y22 (SCTIMST & Barton Hill Engg. Coll. TVM)	376009-001	23.12.2022	Tool for isofixing, isoslicing of large size sheep/pig heart	Sabareeswaran, ranjith gopinath, sachin j shenoy, sowmya ramanan v, anish karimannur john, p harish ram, rebin zachria mathew, smriti m k, r rahul dev, abiram v s, ayush arun, aswanth s, arun anirudhan v
10	IDNES056.Y22 (SCTIMST & Barton Hill Engg. Coll. TVM)	376010-001	23.12.2022	Simultaneous suction irrigator with a 'detachable humming bird break' canulla tip	Prakash nair, anish karimannur john, easwer h v, sanjay h m, m gowtham, rebin zachria mathew, p harish ram, r rahul dev, abiram v s, basil biju k, abhishek a p, rehan sunil dhas, arun anirudhan v, sanjay behari
11	IDNES057.Y22 (SCTIMST & Barton Hill Engg. Coll. TVM)	377054-001	09.01.2023	Adaptive patient trolley-e drive	Smitha v, anish karimannur john, subin sukesan, shrinivas v g, prasanta kumar dash, jayakrishnan c, goutham sai krishna, a arjun, aparna govind, ayush arun, rajeev rajan, dinesh gopinath, sreelal s, arun anirudhan v



Design Registrations (India)						
Sl. No	Ref no	Design no	Date of Filing	Title of invention	Inventors	
12	IDAIO58.Y23	378306-001	31.01.2023	Single use cartridge design for diagnosing nt-probnp from blood samples	Manoj gopi, vani maya, arvind kumar prajapati, harikrishnan sivadasan pillai	
13	IDAIO059.Y23	379337-001	15.02.2023	Multilayer insole subsystem with custom removable pegs for plantar pressure offloading in diabetic walkers	Subhash neyyattinkara neelakandan, vaishnav umesh, muraleedharan chirathody vayalappil	
14	IDNES060.Y23 (SCTIMST &Govt Engg Coll. Barton Hill)	380121-001	25.02.2023	Universal magnetic instrument holder	Prakash nair, sajin raj r g, anish karimannur john, easwer hv, dhanya s, sanjay hm, m gowtham, ayush arun, aswanth s, ravin jayakumar, ananya l nair, s anandhu, arun anirudhan v, sanjay behari	
15	IDNES061.Y23 (SCTIMST &Govt Engg Coll. Barton Hill)	380122-001	25.02.2023	Surgical chair	Prakash nair, sajin raj r g, anish karimannur john, easwer hv, dhanya s, sanjay hm, m gowtham, rebin zachira mathew, aiswarya mohan, adith v s, sreedarsh v, arjun sankar j m, arun anirudhan v, sanjay behari	
16	IDNES062.Y23 (SCTIMST &Govt Engg Coll. Barton Hill)	382039-001	22.03.2023	Automated cardiopulmonary resuscitation device	Smita v, anish karimannur john, rupa sreedhar, prasantha kumar dash, dev narayan, p harish ram, rahuldas a h, devika s nair, amith s nair, dimesh gopinath, arun anirudhan v, krishna sarma s	
17	IDNES063.Y23 (SCTIMST &Govt Engg Coll. Barton Hill)	382255-001	25.03.2023	Patty maker	Prakash nair, sajin raj rg, anish karimannur john, easwer hv, dhanya s, sanjay hm, m gowtham, dev narayan, devika s nair, amith s nair, rahul das ah, p harish ram, arun anirudhan v, sanjay behari	



CUSTOMER SERVICE CELL

Customer Service Cell co-ordinated the internal and external testing services and also study projects for the evaluation of medical devices & biomaterials.

The summary of the testing services is given in the table below.

Training/outreach programs

A. Industry Institute Partnership Cell conducted the following workshops during the year:

- A customized training program was conducted by the Industry Institute Partnership Cell on “Sterilization of medical devices” to M/s DNV Business Assurance which is an international audit group involved in the

testing, certification and technical services. The training was conducted from 13-15th June 2022.

- A workshop was conducted on “Biological safety and efficacy evaluation of medical devices” for the medical device industry during 9-11 January 2023.
- A workshop was conducted on “Biomaterials - Development and Evaluation” during 16-17 February 2023.

B. Visits on exposure to the Institute activities was co-ordinated for the following institutions:

- Dept of MLT, Medical College Thiruvananthapuram

Description	External			Internal		
	2020-2021	2021-2022	2022-2023	2020-2021	2021-2022	2022-2023
No. of work orders	679	433	625	288	270	169
No. of test materials	1062	983	1400	1275	1290	496
Income (Rs)	51,16,440	45,18,429	42,79,943	32,90,800	41,49,780	10,83,340

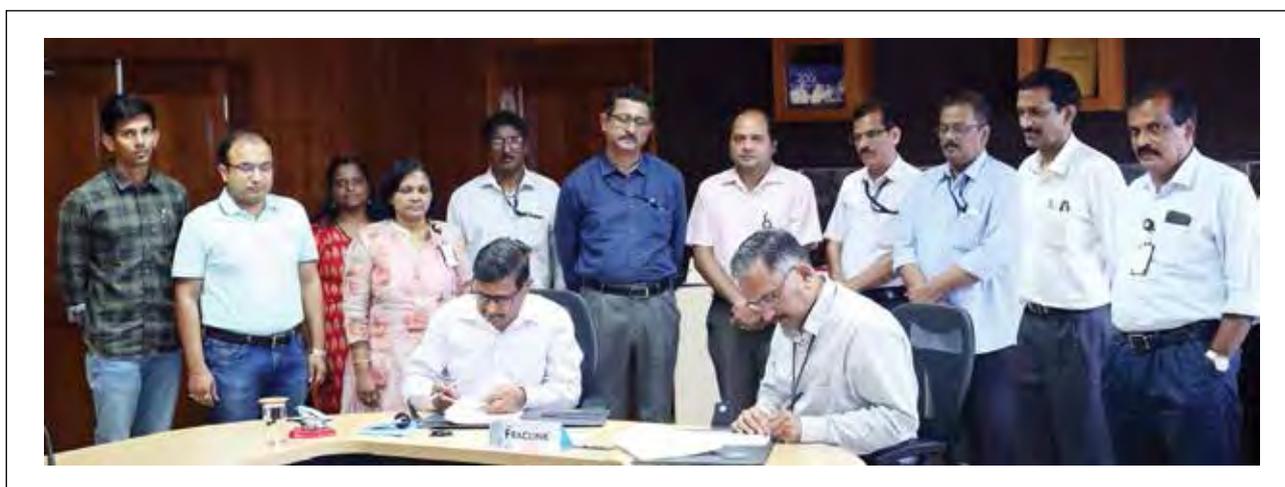


Figure 39: Signing ceremony of Technology Transfer Agreement with M/s Onyx Medicals Pvt Ltd for the product Drug Eluting Bioactive Calcium Sulfate Cement 13.09.2022

- Student members of IEEE Engineering in Medicine and Biology Society
- TKM Institute of Technology, Kollam
- School of medical education, Manimalakunnu
- The School of Good Shepherd, TVPM
- Medical Trust Institute of medical sciences, Ernakulam
- Mar Athanasios college for advanced studies, Thiruvalla
- KSMDDB College, Sasthamcotta
- St. Thomas college of nursing, Chethipuzha
- SG College Kottarakkara
- Govt. Polytechnic, Neyyattinkara
- SN College, Kollam
- Alpha College of Engineering, Chennai
- PSG College of Technology, Coimbatore
- RVS educational trust group of institutions, Dindigul

QUALITY CELL

Activities of Quality Cell include the implementation, maintenance and continual improvement of Quality Management System (QMS). This includes, but not limited to ensuring that the facilities, equipment, personnel, methods, practices, records and its control are in conformance to the requirements of international standards.

Testing and evaluation

Quality Cell is involved in supporting all testing and calibration laboratories as well as the auxiliary support services / sections in maintaining the Quality Management System.

Major activities of the Quality Cell during the period from April 2022 to March 2023 were: -

i. Internal Audits:

- Two internal audits - first (IABMT100.Y22) and second (IABMT200.Y22) were conducted during May 12-25, 2022 and

November 17-25, 2022 respectively.

- Corresponding post audit meetings were conducted on 1st July 2022 and 9th December 2022.

ii. TMC Meetings:

- Two Technical Management Committee meetings were conducted on 1st July 2022 and 23rd December 2022.

iii. MRC Meeting:

- Management Review Committee meeting conducted on 13th January 2023.

iv. COFRAC assessment:

- The renewal assessment of COFRAC, the external accreditation service provider for testing services based on ISO/IEC 17025:2017 was conducted during January 19-20, 2023.

v. National Accreditation Board for Testing and Calibration Laboratories (NABL) assessment:

- NABL re-assessment of Central Analytical Facility was conducted on September 3-4, 2022.
- NABL re-assessment of Calibration Cell was conducted on November 12-13, 2022.

vi. Arrangements for participation in trainings for QMS personnel was done targeted to increase the knowledge, update skill and preparations for the future assignments. The details of trainings participated by QMS personnel are:

- a. Risk Management and implementation in Laboratories as per ISO/IEC 17025:2017 conducted by Quality Council of India on June 3, 2022. Eleven personnel attended the training.
- b. Laboratory System and Internal Audit Training as per ISO/IEC 17025:2017” conducted by Quality Council of India during July 28-29, 2022. Two personnel attended the training.



vii. CDSCO-Medical Device Testing Laboratory:

- Communication regarding changes in top management & personnel etc. were intimated to CDSCO.

viii. ISO 13485:2016 implementation:

- Implementation of the standard by the Committee (constituted for the smooth implementation of the standard) is continuing. The preparation of the draft procedures is almost completed. The committee has proposed to conduct a mock audit by June 2023.

ix. QMS Documentation:

- 13 System procedures, 10 Guidelines, and 148 Work Procedures revised and issued to the Laboratories/sections.
- 57 Laboratory note books & 86 Registers/log book prepared and issued.

Training/outreach programs

Competency Development Cell (CDC) has identified, coordinated/facilitated trainings which are in line with the organizational needs to the employees of BMT wing. This includes training sessions relevant to specific segments of BMT Wing including the four Departments, supporting services (accounts, administration, purchase and others) and Quality Management System. Four training programs were organized during the period 22-23.

- A. CDC organized a two-day Hands-on Training program (hybrid mode through Webex platform) on Government- e Market place (GeM) on 16th and 23rd May 2023. Mr. Manesh Mohan, Business Facilitator GeM, Trivandrum was the resource person for the Two-day training program. A detailed hands on training on GeM was given for general employees as well as for the staffs of Purchase and Stores Division. 116 participants attended these two day sessions.
- B. CDC in association with Chemical Safety group- BMT Wing organized a half day training session (hybrid mode through WebEx platform on

Chemical safety and Disposal on 14th July 2022. Shri Manoj R, Head, Centre Safety Division, Centre Safety Management Group, VSSC, Trivandrum was the resource person for the training program. The programme was intended to give the participants a working knowledge on how to handle chemicals safely and to how to dispose them correctly. 45 participants attended this session.

- C. Induction training programme for the newly joined employees of Bio Medical Technology Wing for the year 2022 was organized by CDC on 16th November 2022. The programme started with an introduction about the Institute by the Associate Head, Shri C V Muraleedharan. Faculty/ officers of BMT Wing in various capacities handled the sessions. The topics included administration formalities and overview of accounts, basic purchase and stores procedures, overview of quality management system, safety of women in work place, bio safety, chemical safety, electrical safety, fire and general safety, IT services and campus facilities. 20 newly joined employees attended the induction training program.
- D. CDC in association with the Quality Cell, BMT Wing, organized an awareness/refresher training Session on "Quality Management system based on ISO/IEC 17025: 2017 - Testing and Calibration laboratories" for the benefit of transferred employees and other personnel related to testing and calibration services SCTIMST on 14th December 2022. Dr. Ramesh P, Quality Manager-BMT wing, HOD Dept. of Medical Devices Engineering and SIC (Joint), Division of Polymeric Medical Devices served as the resource person. 16 staffs attended the training programme.



CONSTRUCTION WING

Construction Wing (BMT Wing) has the function of executing Civil Construction and maintenance work of BMT Wing campus.

Developmental Activities

- Construction of toilet for WSS, ENS
- Painting Toxicology block
- Renovation of primate House
- Renovating damaged roof of Construction Wing.
- Provision of Mosquito net for Students hostel

New initiatives

The following works are initiated through CPWD

- Supply, Installation and Commissioning of Bio-Medical Waste Incinerator including Civil, Electrical and Plumbing works, at Biomedical Technology Wing of SCTIMST.
- Setting up of Bio safety Containment facilities of Bio-safety Level-2 (BSL-2) & Bio- Safety level-1 (BSL-1), Class 10000, Class 100000 Labs at ground Floor & ISO-8 Laboratory at Second floor.
- Providing fan coil unit/AHU, Chilled water piping and PUF insulated doors in Preclinical Evaluation facility located at 1st floor of Combination Devices Block (Wing1).

Achievements

Completion of Combination Devices Block building which has been inaugurated on 15.11.2022.

The following employees were issued Appreciation in recognition of the services rendered in the construction of Combination Devices Block at BMT Wing, SCTIMST

1. Mr Vinod Kumar V, Nodal Officer, Combination Devices Block
2. Col. Vijayan Pillai.K(Retd), Construction Engineer
3. Sri Sreekesh Nair S, Assistant Engineer (Civil)-A

4. Smt Deepa G K, Junior Engineer (Civil)-B

5. Sri Suresh N B, Junior Engineer (Civil)-A

Staff

Faculty

Mr Balram S, Scientist G and Head of the Department

Dr Roy Joseph, Scientist G

Dr Ramesh P, Scientist G, Technical Manager

Mr Vinod Kumar V, Engineer G, Dy. Quality Manager (Medical Devices)

Ms Leena Joseph, Engineer-G, Dy. Technical Manager

Dr Anugya Bhatt, Scientist G, Quality Manager

Ms Sandhya CG, Engineer F

Mr Rajkrishnan Rajan, Engineer F

Mr Sajithlal MK, Engineer F, (Dept. Co-ordinator)

Dr Arun Anirudhan V, Engineer E, Network Service Cell

Dr Naresh Kasoju, Scientist C, Dy. Quality Manager (GLP Studies),

Dr Renjith S, Scientist B

Technical

Mr Willi Paul, Scientific officer (Instruments)

Mr Arumugham V, Jr. Scientific officer (Instruments)

Mr Binu CP, Asst. Engineer (MRAC)

Mr Sabu KS, Jr. Engineer (Electrical)

Mr Sreejith LK, Jr. Engineer (Instrumentation)

Ms Deepa GK, Jr. Engineer (Civil)

Mr Suresh N B, Jr. Engineer (Civil)

Mr Rajesh RP, Sr. Scientific Asst. (Instruments)

Mr Sreekanth SL, Sr. Scientific Assistant

Ms Nimi N, Scientific Assistant (Instruments)

Ms Asha Rani V, Technical Assistant

Dr Sasikala TS, Technical Assistant (Instruments) - A



Mr Sajid A, Technical Assistant

Mr Binu A U, Technical Asst., Network Service Cell
(Instruments)

Mr Erlan Benanson, Technical Asst. (Electrical)

Mr Mahesh R, Technical Asst. (Electrical)

Mr Dilu P, Technical Asst. (Electrical)

Mr SajImon B, Jr. Technical Asst. (Electrical)

Mr Manu MH, Jr. Technical Asst. (Electrical)

Mr Ajithkumar V, Jr. Technical Assistant (MRAC)

Mr Baiju S, Sr. Technician (Electrical)

Mr Ilaya Raja J, Technician (Electrical)

Mr Sivakumar K, Technician (Electrical)

Mr Santhosh Kumar R. S, Technician (Electrical)

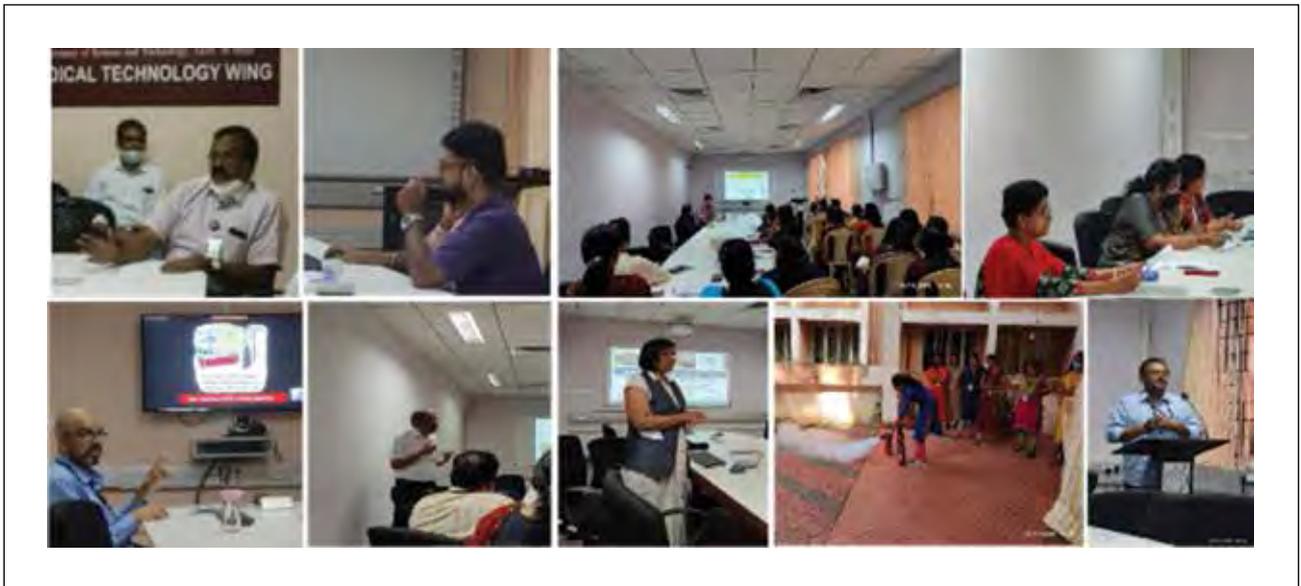


Figure 40 The various programs organised by Competency Development Cell (CDC).



ACHUTHA MENON CENTRE FOR HEALTH SCIENCE STUDIES

ACHUTHA MENON CENTRE FOR HEALTH SCIENCE STUDIES (AMCHSS)

Achutha Menon Centre for Health Science Studies (AMCHSS) has been engaged in teaching and training in health sciences, especially in Public Health, through a 2-year full-time Master of Public Health (MPH) course, one-year Diploma in Public Health (DPH) and PhD in Health Sciences (for both full-time and part-time students). The Centre undertakes research projects and consultancies funded by national and international agencies in non-communicable diseases, Environmental health, Tribal health and Health systems. AMCHSS is part of several advisory committees in governmental and non-governmental agencies and is actively engaged in health-related research and policy formulation.

Activities

New initiatives

- ◆ A MoU is signed between SCTIMST and the Postgraduate Institute for Medical Education and Research (PGIMER), Chandigarh, for the collaborative research on “Cost-effectiveness of Pradhan Mantri Bhartiya Janaushadhi Pariyojana (PMBJP) and its impact on financial risk protection in India.” This study will assess the impact of Pradhan Mantri Bhartiya Janaushadhi Pariyojana in achieving financial risk protection and estimate the cost of implementing PMBJP. (PI Dr Biju Soman)
- ◆ A MoA was signed between SCTIMST and the Kerala Medical Services Corporation (KMSCT) for the annual appraisal of the ‘108’ Ambulance Service in Kerala for 2022-23. (PI Dr Biju Soman)
- Signed MoA between SCTIMST and the Central TB Division of the Ministry of Health and Family Welfare, Govt. of India, for implementing the research project on “Adapting surveillance (Nikshay) data to create decision support systems for tuberculosis elimination in Kerala using spatial epidemiology.” (PI Dr Biju Soman)

New research studies:

- A population-based registry of end-stage renal disease patients on renal replacement therapy in Trivandrum district, Kerala. Funding agency: Trivandrum Nephrology Club. PI: Dr Jeemon P and Dr. Noble Gracious (PhD scholar).

This study will provide population-wide estimates of both the prevalence and incidence of ESRD in Kerala. Further, it will help the research team to delineate the clinical characteristics and practice patterns of ESRD patients in Kerala. It would also provide an opportunity to assess factors associated with mortality outcomes in ESRD patients and to develop a risk stratification model for targeted intensive management.

- Effectiveness of Community-based Intervention for Perinatal Depression and Anxiety: Multicentric study (PI: Dr Jissa VT). This multicentric proposal was submitted to ICMR, and has been accepted in principle, for funding.

Ongoing research programmes

- ◆ Team-based collaborative care model, facilitated by a mHealth enabled and trained nurse, for management of heart failure in India (TIME-HF). Funding Agency: Wellcome Trust-DBT-India Alliance, PI: Dr Jeemon P TIME-HF involves a team-based collaborative care model (CCM), facilitated by a trained nurse to rationalise management of heart failure (HF). The patient-centred approach proposed in our study may improve the uptake of guideline-directed therapies and reduce hospital readmissions and mortality. The specific aims are 1: To conduct stakeholder analyses to identify barriers and facilitators for implementing the CCM for HF management. 2: To assess the effectiveness of the CCM in improving the number of days alive and out of hospital (DAOH) at two-year



in comparison to 'usual care'. 3: To inform the state-level scalability of the intervention model. The three design approaches include: formative qualitative research for aim 1; a cluster randomised controlled trial for aim 2; and cost-effectiveness and evaluative qualitative research for aim 3. We will use qualitative methods to develop the intervention strategy and understand acceptability, reach and impact of interventions. In the proposed cluster RCT, we will develop and test the effectiveness of a comprehensive intervention in 1,500 adult HF patients from 22 units in India. Incremental Cost-Effectiveness Ratios (ICER) will be calculated from a health system and societal perspective. The project is likely to impact the practice of management of HF in low resource settings.

- ◆ Scaling up Interventions to improve the control of hypertension and diabetes in partnership with the governments of Kerala and Tamil Nadu: Leveraging India's National Non-Communicable Disease Program. Funding Agency: National Health and Medical Research Council, Australia; Duration 2021-2025: PI: Dr Jeemon P This proposal will demonstrate, in the two Indian states of Kerala and Tamil Nadu, how low and middle-income countries (LMICs) can achieve reach, adoption and sustainability of primary care interventions to improve diabetes and hypertension outcomes. Our research will develop an evidence-based approach that better links and integrates prevention with disease management at both a community and systems level. Our approach will integrate with and strengthen both state governments' current efforts by building the capacity of the existing health workforce and supporting health systems strengthening. Our findings will also inform decision-makers about (1) How to allocate resources to different implementation strategies; (2) How to market the strategies and to whom; and (3) How much value the strategies will provide (return on investment).
- ◆ Systems thinking approach to developing an integrated and patient-centred intervention

model for multimorbidity care in primary care settings in India. Funding Agency: Medical Research Council UK. Duration: 2021-2023. PI: Dr Jeemon P This proposal will use a system thinking approach and causal loop model to conceptualise how health systems manage patients with multi-morbidity in primary health care settings in India. We will also investigate the ways in which the care for people with multiple chronic conditions can be organised and integrated within the community through community health workers.

- ◆ Understanding disease clustering (multi-morbidity) in the tribal population of Kerala. Funding agency: SCTIMST (Intra-mural), Government of India. Duration: 2021-2024 PI: Dr Jeemon P In this proposal, we are conducting a detailed assessment of multi-morbidity at the individual and family levels in disadvantaged tribal populations in Kerala.
- ◆ The long-term effects of a peer-led lifestyle intervention program on diabetes progression, multi-morbidity, and cardiovascular risk: the Kerala Diabetes Prevention Program (K-DPP). Funding Agency: National Health and Medical Research Council, Australia. Duration 2020-2024: PI: Dr Jeemon P The Kerala Diabetes Prevention Program (K-DPP) is one of the first peer-led structured lifestyle modification (SLM) program for chronic disease prevention developed exclusively for people living in rural areas with limited resources and minimum additional support. The K-DPP model resulted in a non-significant reduction in diabetes incidence at two years of follow-up. The current study is proposed to evaluate the effectiveness of K-DPP in terms of 7-year diabetes and cardiovascular risk-related outcomes. The major objectives are as follows; (1) To understand the impact of a lifestyle modification program on cardiometabolic risk factors and preclinical changes in the microvasculature (retinal microvasculature and Albumin-to-creatinine ratio [ACR]), the reversibility of key CVD risk factors and the impact on predicted 10-year CVD risk, using



the recently developed risk equation for Indians, Globorisk, (2) To undertake economic analysis to justify investments in CVD and related chronic prevention programs., and (3) To measure Community engagement (CE) and program sustainability of KDPP.

- ◆ Kerala diabetes Prevention Project Extension Study. Funding Agency: World Diabetes Foundation. Duration: 2019-2023 PI: Dr. Dr Jeemon P
- ◆ A worksite-based lifestyle program for reducing diabetes and cardiovascular disease in India. Funding agency: National Heart Lung and Blood Institute, USA. Duration: 2016-2023 Lead Investigator: Dr Jeemon P In this project, we implemented and evaluated the acceptability, delivery, effectiveness, and cost-effectiveness of a worksite-based lifestyle improvement package in India. The study aims are: Aim 1: To measure the success of implementation and inform the scalability of this intervention program by evaluating: (a) program adoption by assessing participation and changes in weight and diet and physical activity behaviours among lifestyle class participants; (b) fidelity to the program by assessing activities of study-affiliated worksite staff; changes to the food options at the worksite canteen; management support for the program; and changes in the worksite environment; and (c) acceptability of the program. Aim 2: To measure the effectiveness of the program among participants by evaluating the change in the number of individuals reaching two or more of cardiometabolic risk goals, namely reductions in blood pressure, triglycerides, and HbA1c (the primary outcome), and through changes in secondary outcomes including rates of diabetes incidence and regression to normoglycemia. Aim 3: To measure the value and return on investment of the intervention for employers by assessing program cost and cost-effectiveness and changes in staff productivity, absenteeism, health status, and quality of life.
- ◆ Mental health care and support for recently delivered mothers in Kerala: a community-

based study Funding agency: Women and Child Department, Govt of Kerala. Duration: 2022-2023, Principal Investigator: Ravi Prasad Varma, Co-PI: Jissa VT. There is a dearth of community-based studies on depression in the post-partum period in Kerala, as well as limited literature on healthcare-seeking behaviour and limited description of associated factors grounded in the Kerala context, with almost no literature on men's perspective of post-partum depression (PPD). The objectives of this study include assessing the prevalence of PPD in Kerala and associated factors and mapping the factors that influence PPD. Data will be collected on the ODK platform using trained Anganwadi workers. The study adopted a mixed method approach, including both quantitative and qualitative. The quantitative part of the study comprises a cross-sectional survey among 4200 women in Kerala. In-depth interviews will be conducted among 25 recently delivered women, 25 male family members and 25 female caregivers. Focus group discussions will be held with healthcare providers to help design a training manual on depression in the post-partum period for frontline healthcare workers.

- ◆ Primary Health Care Preparedness and LSGI response in the context of COVID-19 in Kerala, in collaboration with Kerala Institute for Local Administration, Thrissur and Centre for Migration in Development, Kochi. Duration of study: 18 months, started in July 2020 (ongoing) PI: Dr Mala Ramanathan. Collaborative documentation of experiences of LSGIs in terms of implementing the various responsibilities concerning prevention, health promotion and mitigation of distress within their communities and the informational environment in which it happened.
- ◆ 'Provision and Promotion of Spacing Methods under Family Planning Program in Bihar', Funding source: Professional Services Contract (PSC) from the Institute of Economic Growth signed by Director, SCTIMST to compensate for time costs of Dr Mala Ramanathan. Duration



of study: April 2021-Dec 2021, Co-PI Mala Ramanathan with Prof. William Joe, Institute of Economic Growth, Delhi).

- ◆ Delineating the role of DNA methylation in insulin resistance driven breast cancer development and progression (PI: Dr Srikant A) The standardisation of cell culture methods and developing cell culture medium for insulin resistance have been initiated. We have completed standardisation of conditions for developing insulin resistance in mammary epithelial cell line MCF10A and are currently working to standardise insulin resistance development in breast cancer cell lines ZR-75 and BT-474. In parallel, we have developed the standard operating processes to collect samples from patients, isolate nucleic acid and store them. An MoU is signed between RCC, Trivandrum and SCTIMST.
- ◆ Triaging high-risk HPV-positive women for cervical cancer screening in tribal populations from Kerala: a feasibility study (PI: Dr Srikant A).
- ◆ Documenting cause of death among tribal population through automated verbal autopsy using Information and Communication Technology (ICT). DST Tribal Component plan, duration :3 years (2021-24); PI: Dr Jissa; Co-PIs; Dr Biju Soman, Dr Srikant A Data collection is going on in Thiruvananthapuram and Wayanad. So far, around 2000 verbal autopsies have been completed.
- ◆ National Environmental Health Profile-NEHP; Funded by the Ministry of Environment, Forests and Climate Change (MOEFCC); Duration: 2019-2024, PI: Dr Manju R Nair. NEHP is a twenty-city multicentric study that aims to assess the effects of air pollution on health outcomes and to generate a model to predict the burden of health outcomes attributable to air pollution in India.
- ◆ Mobile Telemedicine Project-Wayanad; Funding agency: DST, Govt. of India; Duration: 2017-2023; PI: Biju Soman, Co-PI: Sajithlal MK (BMT wing). Both mobile telemedicine units are made functional. Regular telemedicine consultations are going on. Efforts to integrate the services with the e-Health Kerala program is progressing in collaboration with the Centre for Advanced Computing (C-DAC) Trivandrum.
- ◆ Transforming Covid-19 testing data into actionable evidence for Public Health decision-making using epidemiological, spatio-temporal and data-science methods; Funding agency: ICMR, Govt. of India; Duration: 2022-24; PI: Dr Biju Soman; Co-PIs: Dr Rakhal Gaitonde, Dr Srikant A, Dr Arun Mitra, Dr Gurpreet Singh. The ICMR COVID-19 Testing Data is a living dataset that updates in real-time and has massive data (2TB+) of over 100 crore COVID tests done in the last three years across the country. We have downloaded data till March 2023. Interim analysis of this growing database is being attempted with the R statistical language.
- ◆ Cost effectiveness of Pradhan Matri Bhartiya Janaushadi Pariyojana (PMBJP) and its impact on financial risk protection in India; Funding Agency: DHR, GoI; Duration (2022-23) Collaborative Project with PGIMER, Chandigarh; Site PI Dr Biju Soman. Data collection is going on in both the districts selected for the purpose. Pharmacy data collection is completed in Kottayam, and data collection from patients in the inpatient (IP) and the clinic patients (OPD) are going on.
- ◆ Portable Mobile Refrigerator for difficult to reach areas; Funding agency: DST, Govt. of India; Duration: 2019-22; Collaborators: Centre for Advanced Computing-(C-DAC) Trivandrum, IISc Bangalore and University of Southern Carolina, USA). Site PI: Dr Biju Soman. The project is completed, and a prototype of the unit is created. The detailed technical report got submitted to the funding agency. Successfully filed a collaborative patent application on “Portable Autonomous Temperature Controlled Medical Cabinet” with Indian Patent Application No.: 202041054235 dated 14/12/2020 – for the first 1.5L Prototype.



- ◆ Regional Technical Resource Centre from HTAIn; Funding: DHR, Govt. of India; Duration: 2018-25 PI: Biju Soman. We have completed four full health technology assessments (HTA) on the following topics, 1) Use of Pulse Oximeter as a tool to prevent childhood pneumonia-related morbidity and mortality; 2) Assessment of available technologies for detection of diabetic retinopathy from colour fundus photographs to prevent blindness in India; 3) Cost-effectiveness of screening for chronic kidney diseases in Kerala and Puducherry, 4) Evaluation of Hridayam - A GoK initiative for new born screening for Congenital Heart Defects. The regional centre currently is working on two full HTAs, 1) Effectiveness and cost-effectiveness of the COPD Prevention and Control Program in Kerala (SWAAS), and 2) Pneumococcal Conjugate Vaccine to prevent mortality and morbidity due to pneumococcal disease in adult patients. In addition, we are collaborating with other regional resource hubs to conduct two nationwide studies. Our liaison activities with the various state government functionaries are going on. The centre has actively participated in the International Symposium of Health Technology Assessment (ISHTA 2023), organised jointly by the HTAIn, Ministry of Health & Family Welfare, Government of India and WHO, SEARO on 10 Mar, 2023 in Sushma Swaraj Bhavan, New Delhi. (Fig. 1)

Events organised

- ◆ Dr Soman and his PhD student, Dr Arun Mitra, organised the regional meeting point of the “EDIT-A-THON” workshop on 27/04/2022, in collaboration with the Working Group on Space and Global Health, the United Nations Office for Outer Space Affairs (UNOOSA) at AMCHSS.
- ◆ AMC Seminars: The following three AMC seminars were organised from 2022 Apr to Mar 2023.
 - On 01/10/2022 on the topic: “Multi-specialty teamwork is essential from public health: The case of AMR”, Speaker: Dr Elizabeth Mathai, Retired Prof and Head, Clinical Microbiology, Christian Medical College, Vellore, Consultant to the World Health Organization, Geneva (Retired), Honorary Appointment at Liverpool School of Tropical Medicine, UK (Retired)
 - On 23/02/2023, Dr Devi Mohan, Associate Professor, Monash University, on “Dementia and ageing research in a demographic and health surveillance.”
 - On 06/02/2023 Dr Sundeep Sahay, Professor of Informatics, University of Oslo, Norway, on “Health inequities; how can digital technologies help to mitigate them.”
- ◆ Dr Ravi Prasad Varma organised two workshops in collaboration with the State Health Systems Resource Centre, Kerala.
 1. On 12/05/2022, “Psychometric Tool Development and Validation.”
 2. On 15/01/2023, Intervention design for the study; “Intervention for prevention of falls among older persons in Kerala-a randomised controlled trial.”
- ◆ Dr Mala Ramanathan organised a national symposium titled ‘Contextualising Abortion Access in India-Global Changes and Indian Realities’ on 28 Dec 2022.
- ◆ Dr Soman conducted the fifth cohort of the workshop, “Data Analysis using R for Health Professionals,” along with Dr Gurpreet Singh and Dr Arun Mitra on 06-08 Dec 2022.
- ◆ Dr Soman conducted a workshop on “Spatial Epidemiology using R for Health Professionals” on 9-10, Dec 2022, along with Dr Gurpreet Singh and Dr Arun Mitra
- ◆ Dr Mala Ramanathan organised the Samvaad Lecture series by Richard A Cash on 12 Oct 2022. The topic of the Samvaad lecture was ‘Dealing with Epidemics: Interventions that are attainable, sustainable and Acceptable.’
- ◆ Dr Ravi Prasad Varma organised the following



field programs for the students as a part of the Azadi Ka Amrit Mahotsav observance.

1. Participation in Grama sabha and Oral health check-up in Manickal Grama Panchayat on 26 Dec 2022. (Fig.2)
2. Elderly health check-up and camp on Nellanadu Grama Panchayat on 22 Mar 2023. (Fig.3)
3. Tribal Health Camp, covering Amboori and Kuttichal tribal hamlets in collaboration with the Amboori Community Health Centre on 4 Nov 2022. (Fig.4)
4. Elderly health meetings in Manickal Grama Panchayats on 7, 14 & 21 November 2022. (Fig.5)
5. Dr Varma also facilitated the students to present five papers on this work at International Conference on “Care for Older Adults amidst COVID – 19” organised by the International Institute of Migration and Development (IIMAD), Thiruvananthapuram on December 19 and 20, 2022. (Fig.6)

- ◆ Dr Ravi Prasad Varma P gave a Radio talk on “Iodine Deficiency Disorders” aired by All India Radio-Thiruvananthapuram, Prakasha Dhara, on 21-10-2022
- ◆ Dr Jeemon P appeared on All India Radio, Yuvavavi, as part of an outreach effort to youngsters in Kerala and to promote cardiovascular health on 9 Dec 2022.

Awards and honours

- ◆ Dr Jeemon P: 2022 Best Investigator Award (Low and middle-income country region), International Behavioural Trials Network and University of Montreal, Canada
- ◆ Dr Jeemon P: 2023 Finalist, British Council, UK Alumni Awards
- ◆ Dr Jeemon P: 2022 Best Public Health Research Project, SCTIMST

- ◆ Dr Jeemon P: Nominated as Advisory board member: World Health Organisation Global Health Foresight Horizon Scan Exercise
- ◆ Dr Jeemon P: Nominated as Member, Innovation Cell, Kerala University of Health Sciences
- ◆ Dr Jeemon P: Consistently featured in the top 2% of scientists worldwide by Stanford University
- ◆ Dr Jeemon P: Featured in the Asian Scientist Magazine as one of the top 100 scientists from Asia and in the ‘Tell Me WHY’ magazine, Malayala Manorama, as one of the leading 100 scientists from India.
- ◆ Dr Rakhal Gaitonde joined as a member of the Lancet Citizens Commission.
- ◆ Dr Rakhal Gaitonde joined as an expert to endorse the activities of the Alliance for Health Policy and Systems Research by the WHO.
- ◆ Dr Mala Ramanathan is the Working Editor for the journal Indian Journal of Medical Ethics
- ◆ Dr Arun Mitra, a PhD student of Dr Biju Soman, won the best oral paper presentation at the Young Leaders National Conclave, IAPSM, organised at AIIMS, Bhubaneswar, on 10th-12th November 2022. Title: Caesarean Sections in India: “A geospatial exploration of Data from the National Family Health Survey”

Staff

Faculties

- Dr Biju Soman, Professor & Head
- Dr Sankara Sarma P Professor (Senior Grade)
- Dr Mala Ramanathan, Professor (Senior Grade)
- Dr Srinivasan K, Professor
- Dr Rakhal Gaitonde, Professor
- Dr Ravi Prasad Varma P, Additional Professor
- Dr Jeemon P, Associate Professor
- Dr Srikant K, Associate Professor
- Dr Manju R Nair, Scientist D
- Dr Jissa VT, Scientist C





Figure 1: Dr Soman explaining the HTA activities of SCTIMST with the honourable Vice President, Shri. Jagdeep Dhankar, in the presence of the honourable Union Minister of Health, Dr Mansukh Mandaviya, at ISHTA-2023 in New Delhi on 10/03/2023



Figure 4: Tribal Health Camp covering Amboori and Kuttichal tribal hamlets in collaboration with the Amboori Community Health centre on 4 Nov 2022.



Figure 2: MPH students at the Gramasabha and Oral health check-up in Manickal Grama Panchayat on 26 Dec 2022



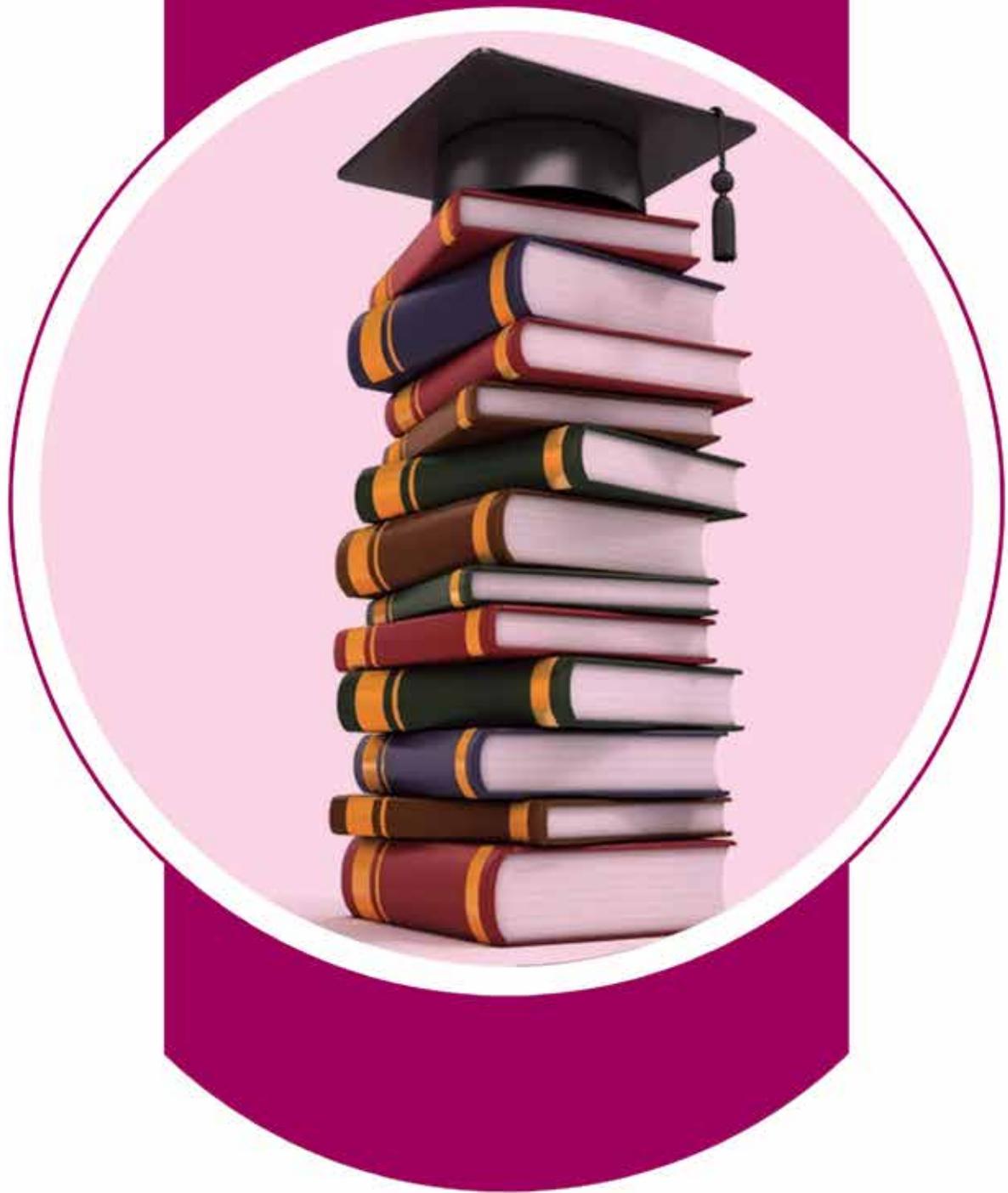
Figure 5: Elderly health meetings in Manickal Grama Panchayats on 7, 14 & 21st of November 2022.



Figure 3: Students at the elderly health check-up and camp on Nellanadu Grama Panchayat in 22 Mar 2023



Figure 6: Students and faculty at the International Conference on "Care for Older Adults amidst COVID – 19" organised by the International Institute of Migration and Development (IIMAD), Thiruvananthapuram, on December 19 and 20, 2022



DIVISION OF ACADEMIC AFFAIRS

DIVISION OF ACADEMIC AFFAIRS

The Sree Chitra Tirunal Institute for Medical Sciences and Technology, Trivandrum continues to be a much sought-after destination for super specialty courses leading to DM or MCh Degrees in Cardiac and Neurosciences. This is also one of the few institutions that offer post-doctoral fellowship programs in subspecialty areas of Cardiac and Neurosciences. In addition, the Institute offers Masters and PhD courses in Medical, Biomedical, and Health Sciences and, Diploma and PG Diploma courses in related areas.

Activities

Programmes offered during the year 2021-22

Post-doctoral Programmes

1. DM Cardiology
2. DM Neurology
3. DM Neuroimaging and Interventional Neuroradiology
4. DM Cardiovascular Imaging and Vascular Interventional Radiology
5. DM Cardiothoracic & Vascular Anaesthesia
6. DM Neuroanaesthesia
7. MCh Cardiovascular & Thoracic Surgery
8. MCh Vascular Surgery
9. MCh NEUROSURGERY (AFTER MS)
10. Post-doctoral Fellowship (Post DM/MCh/DNB)

PhD/Master's programmes

1. MD in Transfusion Medicine
2. Master of Public Health (MPH)
3. PhD (Full Time) & (Part Time)

Diploma programmes

1. Diploma in Public Health

2. Diploma in Cardiovascular & Thoracic Nursing
3. Diploma in Neuro-Nursing
4. Diploma in Operation Theatre and Anaesthesia Technology
5. Diploma in Advanced Medical Imaging Technology

PG Diploma programmes

1. Cardiac Laboratory Technology
2. Neuro-Technology
3. Medical Records Science
4. Clinical Perfusion
5. Blood Banking Technology

Newly initiated programs

1. Integrated MD-PhD
2. Integrated DM-PhD
3. Integrated MCh-PhD
4. MS in Biomedical Sciences and Engineering

Other programmes

Joint Programs with other institutions (IIT Madras & CMC Vellore)

1. MTech (Clinical Engineering)
2. PhD (Biomedical Devices and Technology)

Affiliated programs conducted at other centres

A. National Institute of Epidemiology, Chennai.

1. Master of Public Health (Epidemiology and Health Systems)

B. Christian Medical College, Vellore.

1. MS Bioengineering



2. PhD in Bioengineering/Biomedical Sciences
3. Master of Public Health (MPH)

The details of the students/residents admitted from April 2022 to March 2023 are given below.

The annual selection process for January Session admission to various programs was carried out in the months of November and December 2022. The selection for PhD (Fellowship holders) and MPH/DPH (July session) was conducted in May & June 2022. The newly admitted students were welcomed at a function held on 11th January, 2023 where the Director, Dean and various senior faculty members addressed them.

The Orientation Program for the Senior Residents and students was conducted online from 25.10.2022 to 31.10.2022 by various departments. The student community attended national and international conferences and brought laurels to the Institute by winning best oral and poster presentation awards.

Admission process

Admissions to various programs of study are regulated by policy and procedures recommended by the Academic Committee (AC) and approved by the Governing Body (GB) of the Institute from time to time. The admission announcement was published all over India through advertisements in leading newspapers during the first week of September 2022 and on the Institute website. The assessment and interviews for admission to DM/MCh/MD programs were conducted through INI-SS/INICET and Post Doctoral Fellowship, postgraduate, and diploma programs were held in the Institute during the months of November/December 2022. Admissions to PhD (Fellowship holders), Master of Public Health, and Diploma in Public Health were carried out in July 2022. Admission notifications for the July session for the academic programs PDF, Integrated MD-PhD & DM/MCh-PhD, MSBMSE, PhD (Fellowship holders), PhD Institute fellowship for ST category, MPH and DPH were published during March 2023.

Number of students enrolled from 01.04.2022 to 31.03.2023

In total 158 students were admitted during 2022-23.

Program	Number of students	Program	Number of students
DM	31	MPH (SCTIMST)	25
MCh.	7	MPH (NIE)	20
PDF	13	MPH (CMCV)	Nil
MD	1	PhD (BMT/HOS/AMCHSS/CMCV)	23
MTech	10	Diploma/PG Diploma/Certificate	28

The total number of registered students as per the records as of 31st March 2023 was 434

Short-Term training/Observership

The Institute provided short-term training/observership to candidates sponsored by Government/Autonomous Institutions, Health Sector Organizations, Approved Medical/Dental/Nursing/Engineering Colleges, and other Paramedical Institutions during 2022-23. The training/observership was arranged in consultation with the respective Department/Discipline. Observers from various institutions all over the country spent varying periods from 15 days to 3 months in different Departments of the Institute. A total of 321 candidates completed their observership/internship/project work/training at SCTIMST during the year 2022-2023

Workshop

A one-day workshop on “Paper Writing Skills” was organized by the Division of Academic Affairs for the members of the faculty, senior residents, and students of SCTIMST on the 28th of April 2022. The resource person for the workshop was Prof. Achuthsankar Nair, Department of Computational Biology &



Bioinformatics, University of Kerala, Kariavattom, Thiruvananthapuram. There were twenty-two participants in the workshop.

Annual Convocation

The institute conducted the 38th Annual Convocation ceremony on 21st May 2022. In total, 168 students were awarded degrees.

New academic awards instituted in four different categories to encourage and recognize faculty members, residents, and students of our Institute, were distributed during the occasion. Dr. Mohandas & Dr. Richard A. Cash award to the best outgoing MPH student from AMCHSS was also distributed. The new website for the Institute Alumni portal was inaugurated by Prof. V. Kamakoti, Director, IIT Madras.



Figure 1: Annual Convocation ceremony on 21st May 2022.





Figure 2: Heads of the Departments declaring the degrees



Figure 3: Photos of National Science Day Celebration 2023

Degrees/Diplomas/Certificates awarded during the year 2022-2023.

One hundred and sixty-one students were found eligible to receive degrees/diplomas/certificates during the period 2022-2023.

Program	No. of students	Program	No. of students
DM	27	MS Bioengineering	01
MCh.	07	Diploma in Cardiovascular & Thoracic Nursing	05
PDF	12	Diploma in Neuro nursing	11
MD	01	PG Diploma in Blood Banking Technology	02
MTech	00	PG Diploma in Clinical Perfusion	02
DPH	01	PG Diploma in Cardiac Laboratory Technology	03
MPH (SCTIMST)	21	PG Diploma in Medical Records Science	02
MPH (IIPH)	49	Diploma in Advanced Medical Imaging Technology	03
MPH (CMCV)	02	Diploma in Operation Theatre and Anaes-thesia Technology	02
MPH (NIE)	00	PG Diploma in Neuro Technology	03
PhD (BMT/HOS/AMCHSS/IITMK)	07	ACP in Physiotherapy in Cardiovascular Sciences	00



Figure 4 Hindi Fortnight Celebration



INSTITUTE DAY & NATIONAL SCIENCE DAY 2023 CELEBRATIONS

National Science Day was celebrated on 28th February at BMT Wing, SCTIMST as part of “Azadi Ka Amrit Mahotsav” celebrations in SCTIMST. The Theme was ‘Global Science for Global Well-being’ with a focus on generating public awareness of the scientific findings, in a global context. As part of the National Science Day celebration, SCTIMST organized laboratory visits for students from the University College, and Mar Ivanios College, Thiruvananthapuram. Padma Vibhushan Dr. G. Madhavan Nair, former Secretary to the Dept. of Space, Government of India, and former Chairman, ISRO was the chief guest who delivered the science day message.

EMPOWERMENT OF SC AND ST STUDENTS

Science and technology play a vital role in the development of a knowledge society. Transmission of knowledge through education and training to various sections of society would improve the human condition, especially that of the less privileged scheduled caste (SC) and scheduled tribe (ST) communities. Science for Equity Empowerment and Development (SEED) Division, Department of Science and Technology, Government of India granted two projects to SCTIMST entitled, “Extending benefits of biomedical science and technology to SC and ST communities through all level participatory engagement – SC/ST components.” These projects aimed to bring an impact on the education, skill development, employability, and health of Scheduled caste and Scheduled tribe communities in the country through a series of interventions. The activities carried out as part of the above projects are described below:

DST-SCTIMST Summer Scholarship Program

This training was offered to students who were undergoing/completed higher secondary, graduate, and post-graduate courses in the areas of science, engineering, or medicine. All the students who completed the training with 80% attendance were given monthly scholarships. Students admitted in this program got the opportunity to interact with scientists/ engineers/ clinicians of the institute, visit R&D labs/

clinics of SCTIMST, interact with PhD students, and undertake mini-projects in biomedical research under the mentorship of a faculty member. Students were admitted on a first-come, first-served basis. During the period from March 2022 to July 2022, 16 SC students and 18 ST students were trained. Training certificates were given to students who successfully completed the training.

ONLINE ACTIVITIES

During the year, various activities such as examinations, Question Papers, Thesis evaluations, Answer sheet evaluations, etc. are conducted online. All admission procedures are made online. Online application submission and application fee payment were the initial steps to apply for the programs conducted at SCTIMST. This was made completely online using indigenously developed online software. SCTIMST has the facility to conduct the entrance examination online through Moodle. Question paper setting and evaluation of answer sheets were also performed with the indigenously developed portal for the same. Dissertation/thesis evaluation and answer sheet evaluation, etc. were made online through the computer center of the institute-developed software ‘Examinator’. Various other meetings in connection with academic activities are also conducted online.

HINDI CELL

During the year 2022-23, Hindi Cell Conducted Official Language Implementation Committee meetings every quarter and submit quarterly progress reports to the Department of Official Language. Translated various orders, Notifications, Circulars, etc. published in the intranet. To improve the use of Hindi, the Hindi cell periodically conducted Hindi Workshops and training for the employees of the institute.

Hindi Cell organized Hindi Fortnight Celebration from 19.09.2022 to 06.10.2022. Various competitions like Essay Competitions, Noting and Drafting, Handwriting Competitions, Dictation, and translation Competitions, etc. are conducted and in the closing ceremony awards were distributed. The chief guest of the closing ceremony was Ms. Rohini S, Assistant



Director (OL), Office of the Accountant General, Trivandrum. During the closing ceremony, Hindi Magazine 'Chitralkha' (July – December 2022) was released.



Figure 5: The Parliamentary Committee on official language

THE INSPECTION OF THE PARLIAMENTARY COMMITTEE ON OFFICIAL LANGUAGE

On 26.09.2022, The Parliamentary Committee on official language conducted an inspection of the Institute. The committee appreciated the efforts taken by the institute for the implementation of the official language at SCTIMST and gave suggestions to improve the existing modalities. The action taken for the suggestions after three months and six months after the inspection was submitted to the Parliamentary committee in official language through DST.

TOWN OFFICIAL LANGUAGE IMPLEMENTATION COMMITTEE (TOLIC)

The institute participated in Town Official Language Implementation Committee (TOLIC) meetings

regularly. TOLIC has announced the TOLIC Official Language Awards 2021-22 for best OL performance. 'CHITRALEKHA' the 'In House Hindi Magazine' of SCTIMST, has been selected for special mention. The award was received in the award ceremony.

The employees from our institute also participated in the various competitions conducted by TOLIC during the RajbhashaParv 2022-23. Dr. Amita. R, Assistant Professor, and Dr. Jyothi E.K, Scientist C have received First Prize in the Quiz competition and Ms. Kaveri B.S., Upper Division clerk –A has received Consolation Prize for the competition 'What the Picture says'?



Figure 6: Town Official Language Implementation Committee (TOLIC) meetings

Faculty

Prof Sanjay Behari, Director & Chairperson

Dr Roy Joseph, Dean of Academic Affairs

Prof Sylaja PN, Associate Dean (Student & Faculty Affairs)

Prof Harikrishnan S, Associate Dean (Research & Publication Cell)

Prof Manikandan S, Associate Dean (Examinations & Curriculum)

Dr Umashankar PR, Associate Dean (PhD Affairs)

Prof Srinivasan K, Associate Dean (Health Science Studies)

Dr Santhosh Kumar B, Registrar

Ms Radha M, Deputy Registrar

Staff

Ms Chithra TS, Assistant Administrative Officer (Academic)

Mr Sarath Sam SS, Executive Assistant

Ms Smitha PM, Executive Assistant



NURSING EDUCATION

Activities

1. The 34th batch of cardiac nursing specialty students and the 30th batch of Neuronursing students graduated in December 2022.
2. Overall, for both courses the student strength during the year was 34 students (Diploma in CVTS- 17 and Diploma in Neuronursing-17). The details are provided in the table below.

Program	Number of students in 2022		Students graduated in December 2022	Remarks
	First-year	Second year		
Diploma in Cardiovascular and Thoracic Nursing	08	09	08	One student discontinued after getting a job at AIIMS, Bhubaneswar.
Diploma in Neuro Nursing	07	10	10	All students completed the course.

3. Clinical Observership - Clinical observership was arranged for 57 MSc Nursing students from various colleges of nursing within the state during the year.

participation) in preventing spread of infectious diseases.

An informative video ‘Heart Core’ was made by the students in association with World Rhythm Day Celebrations held on June 9th 2022.

Events organized

- ◆ Nursing Research Day-2022: organized as part of the International Nurses’ Day Celebration-2022 by SCTIMST
- ◆ Webinars on the following topics were conducted Literature Search- Approach and methods Using bibliographic software for research paper writing
- ◆ Organised competitions of Scientific Paper Presentation of Research studies/ Case Reports for the students and nursing officers of the Institute on 09/05/2022.
- ◆ As part of World Hand Hygiene Day Celebrations the students showcased a skit on the theme “Unity for safety, clean your Hands” on 05/05/2022 demonstrating the importance and impact of teamwork (health care workers and community

- ◆ Collaborative Educational Activities by the Division: With the Society of Cardiac Nurses (SOCN) from AIIMS, New Delhi involved as resource person for the following short-term courses conducted for nurses all over India:

Research Methodology and Statistical Analysis

Diagnostic and Interventional Cardiology- Capacity Building Program for Nurses’.

Staff

Faculty

Ms. Suja Raj L, Lecturer in Nursing



LIBRARY, HOSPITAL WING

The Hospital Wing library has a collection of 16034 books and 15931 back volumes of journals. During the current year, the library subscribes to 110 journals. Electronic access to the journals we subscribe to was activated and made available on both campuses.

Being part of the National Knowledge Resource Consortium (NKRC), the library continues to get access to the full text of selected journals from Elsevier, Wiley, Springer, Oxford University Press, American Chemical Society, Royal Society of Chemistry, Nature Publishing Group, Taylor & Francis, etc. and databases of Web of Science and ASTM Standards.

The publications of our Institute from 1977 onwards have been listed on the library site with an interface to search by date, department, and author. The average impact factor of the journals in which the articles are published is also available.

Library-subscribed resources are available to our users through MyLOFT remote access software outside the campus since July 2021.

Royal Family Collection (a collection of books published by the erstwhile ruling family of Travancore) in the library was inaugurated on 11th October 2022 by Royal Family member in the presence of honorable Director Dr. Sanjay Behari and Dean Dr. V.K. Ajit Kumar.

Staff

Ms Sudha T, Librarian-cum-Information Officer - A

Mr Anil Kumar C, Sr. Librarian-cum-Documentation Officer - A

Mr Joy Vithayathil, Sr. Librarian-cum-Documentation Assistant -B

Mr Jayamohan CS, Librarian-cum-Documentation Assistant - B



LIBRARY, BMT WING

The library of the Biomedical Technology Wing has 11464 books, 6019 back volumes, and subscribes to 51 journals. The library continues to subscribe to ASM Medical Materials Database, a comprehensive, peer-reviewed database providing a single relational resource to summarize scientific and engineering knowledge on implantable medical materials data to support surgical, cardiovascular, orthopedic, and neurological medical device design developed by ASM International. The library has a good collection of standards and patents. The standards essential for the Quality Management System and R&D activities of BMT Wing were updated regularly.

The Document Archiving Cell forms part of the library and the Librarian-cum-Documentation Officer acts as the Document Archivist.

Staff

Dr Dimple Gopi, Librarian-cum-Documentation Officer - A

Ms Seema S, Librarian-cum-Documentation Assistant-B

MEDICAL ILLUSTRATION

Medical Illustration is working as part of the healthcare team and spending time working with doctors, nurses, scientists, and other professionals involved in delivering patient care.

The Section documents and archives surgical and treatment procedures and patient progress for training and development purposes. These images can also be used to educate trainee doctors and budding medical scientists. In addition, the Section also creates charts, posters, and other resources used for annual reports, journal publishing, education, and research and development activities.

The division is required to undertake other photographic duties along with clinical work, such as

public relations photography, location photography, medical-legal photography, and creative studio work.

Computer-based audiovisual services such as web streaming, video conferencing, and live broadcast services were provided in clinical education, national and international conferences, seminars, Annual Convocation, GP Oration and Technology Conclave.

Staff

Mr Lijikumar G, Scientific Officer

Mr Viji Kumar NP, Senior Projectionist



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EXTERNALLY-FUNDED RESEARCH PROJECTS (ONGOING)

Hospital Wing

Title of the Project	Principal Investigator	Funding Agency
ISCHEMIA: International Study of Comparative Health Effectiveness with Medical and Invasive Approaches	Dr Ajit Kumar V K	National Institutes of Health, USA & New York University School of Medicine
Tichval-2 Pilot Study TTK Chitra Titanium Heart Valve (Model –Tc2) Clinical Pilot Study	Dr Vivek Pillai	TTK Health Care
Prospective single arm, multi-center, observational registry to further validate safety and efficacy of Ultimaster DES system in unselected patients representing everyday clinical practice	Dr Bijulal S	Terumo India Ltd.
Novel technique of developing trans-catheter heart valve from human homograft for percutaneous pulmonary valve replacement	Dr Bijulal S	Biotechnology Industry Research Assistance Council (BIRAC)
Contemporary outcomes in cardiac channelopathies guided by genotype-based management	Dr Narayanan Namboodiri K K	ICMR
Centre for Advanced Research and Excellence in Heart Failure - overall management of the Project	Dr Harikrishnan S	ICMR
Centre for Advanced Research and Excellence in Heart Failure - Biobank	Dr Harikrishnan S	ICMR
Centre for Advanced Research and Excellence in Heart Failure - NGS Genetics	Dr Harikrishnan S	ICMR
Centre for Advanced Research and Excellence in Heart Failure - National HF Database	Dr Harikrishnan S	ICMR



Centre for Advanced Research and Excellence in Heart Failure - Economic Impact	Dr Harikrishnan S	ICMR
Centre for Advanced Research and Excellence in Heart Failure - Quality of Life	Dr Harikrishnan S	ICMR
Centre for Advanced Research and Excellence in Heart Failure - NT proBNP Point-of-Care device development	Dr Harikrishnan S	ICMR
Centre for Advanced Research and Excellence in Heart Failure - Structured Physical Training	Dr Harikrishnan S	ICMR
Trivandrum Heart Failure Cohort	Dr Harikrishnan S	ICMR
National Heart Failure Registry	Dr Harikrishnan S	ICMR
Congenital heart disease registry for newborns in Trivandrum	Dr Deepa S Kumar	ICMR
Prospective study of patients undergoing micro neurosurgical procedures through a midline inter-hemispheric transcallosal approach	Dr Mathew Abraham	Chitra Alumni Educational and Research Foundation
Predictors of visual outcome and recurrence following surgical resection of medial sphenoid wing meningiomas	Dr Mathew Abraham	Chitra Alumni Educational and Research Foundation
Retrospective study of the surgical outcome of anterior petrosectomy approach for posterior fossa and Meckels cave lesions over a period of 6 years from 2014 to 2019	Dr Mathew Abraham	Brain Lab Pvt. Ltd.
Real time assessment of shift of ICA during extended endoscopic skullbase surgery using intraoperative doppler and the role of tumour consistency in causing ICA displacement	Dr Prakash Nair	SERB
Development of HPC tools for CFD-based patient specific management of Cerebral Aneurysms	Dr B Jayanand Sudhir	National Supercomputing Mission (NSM)



Computational Fluid Dynamics based tools to the aid of clinical decision making in the management of intracranial aneurysms	Dr B Jayanand Sudhir	SERB
Virtual reality-based solution for effective neuroanatomy teaching	Dr Kesavadas C	SERB
Development of portable low-cost disposable defibrillator for cardiac arrest management	Dr Manikandan S	DST
General Anesthesia vs Sedation -Cognitive decline in elderly - A randomized controlled trial in patients with chronic subdural hematoma (GAS-CDE)	Dr Smita V	DST
Comprehensive and novel model for health care in geriatric pain conditions in India	Dr Subin Sukesan	Kusuma Trust, U K
Establishment of the India Stroke Clinical Trial Network (INSTRuCT)	Dr Sylaja P N	ICMR
Ayurvedic treatment in the rehabilitation of ischemic stroke patients in India: A Randomized Controlled Trial (RESTORE)	Dr Sylaja P N	ICMR
Improvement of secondary prevention in stroke survivors by a primary health care approach	Dr Sylaja P N	ICMR
HTA of National Stroke Care Registry Programme: Development of hospital based stroke registries in different regions of India	Dr Sylaja P N	ICMR
Improv-is-ation (Improving stroke care in India – Advancing the INSTRuCT Operations and Network)	Dr Sylaja P N	NIHR, UK
A Comprehensive framework for treatment of impairment of upper extremity due to stroke by computational modelling and virtual reality	Dr Sylaja P N	MHRD & TCS under UAY scheme



Early versus Late initiation of direct oral Anticoagulants in post-ischaemic stroke patients with atrial fibrillation (ELAN): An international, multicentre, randomised-controlled, two-arm, assessor-blinded trial	Dr Sylaja P N	Insel Gruppe AG University Hospital of Bern Switzerland
Medication adherence and management of risk factors for secondary prevention of stroke using smart phone-based application: A feasibility study	Dr Sylaja P N	World Stroke Organization, Switzerland
Incidence, prevalence, risk analysis of dementia and basic research thereof	Dr Ramshekhar Menon	DBT through NBRC
Genetics of complex pediatric epilepsy syndromes: Electro-clinico imaging based genotype-phenotype correlations in an Indian cohort	Dr Ramshekhar Menon	ICMR
Exploring the human gut microbiome and metabolome in health and Parkinson's disease- a window to the gut microbiota brain axis alterations in Parkinson's disease	Dr Syam K	ICMR
Spiral Dx: Tremor diagnosis and quantification using artificial intelligence	Dr Syam K	DBT
Clinical Registry of Movement Disorders	Dr Syam K	Movement Disorders Society of India
Enhancement of Research and Clinical resources of Movement Disorder Program under the Comprehensive Care Centre for Movement Disorder, SCTIMST	Dr Syam K	Dr T S Ravikumar Foundation, USA
Encoding of interhemispheric interactions in mirror dystonia: A window to the physiology of dystonia	Dr Divya K P	Dystonia Medical Foundation, USA
Deciphering the genetic architecture of Parkinson's disease in Indian population	Dr Divya K P	Michael J Fox Foundation, USA



Genetic architecture of Parkinson's disease in India	Dr Divya K P	Michael J Fox Foundation, USA
Comprehensive Care Centre for Neurodevelopmental Disorders	Dr Soumya Sundaram	Federal Bank Hormis Memorial Foundation
Emotional Face Recognition: Understanding the underlying neural connectivity in high functioning adolescents with autism	Dr Soumya Sundaram	DST
Indian Multiple Sclerosis and Allied Demyelinating Disorders Registry and Research Network	Dr Sruthi S. Nair	ICMR
Can cardiovascular patients with obstructive sleep apnea have adverse perioperative outcomes - A prospective study	Dr Sapna Erat Sreedharan	Resmed Foundation
Prevalence of atrial cardiopathy in cryptogenic strokes in comparison with strokes of known etiology - A prospective study	Dr Sapna Erat Sreedharan	ICMR
Dynamic modelling of - synucleinopathy pathology using hiPSC-derived cerebral organoids for biomarkers and drug screening application	Dr Divya M S	National Centre for Biological Sciences
DNA methylation profiling of gangliogliomas and dysembryoplastic neuroepithelial tumors	Dr Rajalakshmi P	SERB
Role of connexins in cardiac fibroblast phenotypic transformation and extra cellular matrix synthesis in cardiac diseases	Dr Neethu Mohan	ICMR
Regulation of progenitor cell function in heart by angiotensin	Dr Neethu Mohan	ICMR



Resting state functional magnetic resonance imaging and its cognitive correlates in patients with intracranial dural arteriovenous fistulas before and after interventional therapy	Dr Bejoy Thomas	DST
Transcriptional and translational regulation of periostin and its interaction with DDR2 in cardiac fibrosis	Ms Sruthi Radhakrishnan	DST
A prospective cohort study on cerebrospinal fluid (CSF) diversion catheter related infections in a tertiary referral neurosurgical care center	Dr Dinoop K P	ICMR
A randomized, multicentric, double-blind, placebo-controlled clinical trial of <i>Nardostachys jatamansi</i> and <i>Withania somnifera</i> formulation (SDA-217) as add-on therapy in patients of chronic insomnia	Dr Ashalatha Radhakrishnan	ICMR
Development of an artificial intelligence- based system for comprehensive cerebral arterial stroke imaging and prognostication	Dr Santhosh K	DBT
Effect and outcome determinants of right ventricular function in post-operative Tetralogy of Fallot: A retrospective descriptive study	Dr Baiju S Dharan	ICMR
Identification and characterization of ubiquitin and SUMO modified exosomal proteins from Parkinson's disease patients' blood	Dr Madhusoodanan U K	ICMR
Prognostic value of circulating microRNAs in heart failure	Dr Sanjay G	ICMR
Randomized placebo-controlled trial of digoxin in patients with rheumatic heart disease	Dr Sanjay G	ICMR



Non-invasive measurement and monitoring of pulmonary congestion	Mr Shaj Upendran	DST (through NIT Calicut)
Development of device for non-invasive continuous measurement of jugular venous saturation	Mr Manoj G S	DST
Molecular mechanisms of stress-induced NLRP3 activation and neuroinflammation by macrophages in presence of amyloid-beta in Alzheimer`s disease	Dr Sreenivas G	ICMR
Comparing mitochondrial function and dynamics in atrial tissue of patients undergoing cardiopulmonary bypass surgery and aortic valve repair	Dr Sreenivas G	SERB
Study of the effect of donor characteristics and component processing methods on formation of microparticles in stored blood using flowcytometric approach	Dr R Amita	SERB

Biomedical Technology Wing

Title of the Project	Principal Investigator	Funding Agency
Defining the mechanobiology that leads to heterogeneity in muscle stem cells and its implication in regeneration	Dr Praveen K S	SERB (Ramanujan Fellow)
Bioengineered construct with cardiac mesenchymal cells for myocardial repair	Dr Senthilkumar Muthuswamy	DBT (Ramalingaswamy Fellow)
Blood-brain barrier permeable nanocarriers for diagnosis and therapy of neurodegenerative diseases	Dr Jayasree R S	DBT
Development of 'Human on-a-chip' device technology - A paradigm shift in biological evaluation and disease model	Dr P V Mohanan	DST



Extending benefits of biomedical science and technology to SC & ST communities through all level participatory engagement - ST components	Dr Roy Joseph	DST
Extending benefits of biomedical science and technology to SC&ST communities through all level participatory engagement - SC components	Dr Roy Joseph	DST
Development of P modified glass-ionomer cement to improve mechanical properties	Dr Manju S	SERB
Efficacy evaluation of 3D bioprinted liver constructs established from niche-specific bioink and stem cell- derived hepatocyte-like cells	Dr Anilkumar P R	SERB
Design and development of a micro dialysis set-up for cerebral applications	Dr Chhavi Gupta	DST
Gender Advancement for Transforming Institution (GATI)	Dr Jayasree R S	DST
Development of plasticizer-free acrylic denture soft liners using nanogel additives	Dr Manju S	DBT
Development of pedicle screw-based dynamic stabilization systems for degenerative diseases of lumbosacral spine	Mr Arvind Kumar Prajapathi	DST
Design and development biodegradable orthotic wrist support device from short coir fiber reinforced polylactic acid biocomposite	Dr Gijo Raj	Tata Steel Ltd.
Bio-inspired total foot pressure off-loading device for diabetic foot ulcer management in geriatric population	Mr Subhash N N	DST
Synthesis & Characterization of Zn-Fe layered double hydroxide 3D scaffold loaded with anti-inflammatory peptide	Megha KB	SERB

Achutha Menon Centre For Health Science Studies



Title of the Project	Principal Investigator	Funding Agency
Resource Centre/HUB for conducting “Health Technology Assessment”	Dr Biju Soman	Department of Health Research, Government of India
National Environmental Health Profile	Dr Manju R Nair	Ministry of Environment, Forest and Climate change
Mobile Telemedicine Project for Waynad	Dr Biju Soman	DST
A family-based randomized controlled trial of cardiovascular risk reduction in individuals with family history of premature coronary heart disease in India	Dr Jeemon P	Wellcome Trust DBT India Alliance
The long-term effect of peer-led lifestyle intervention program on diabetes progression and cardiovascular risk: The Kerala Diabetes Prevention Program	Dr Jeemon P	National Health and Medical Research Council, Australia
Worksite-based lifestyle program for reducing diabetes and cardiovascular risk in India (India-Works)	Dr Jeemon P	Madras Diabetes Research Foundation/ Emory University
Team-based collaborative care model, facilitated by a mHealth enabled and trained nurse, for management of heart failure in India (TIME-HF)”,	Dr Jeemon P	Wellcome Trust-DBT India Alliance
Scale up of an adapted Kerala Diabetes Prevention Program to improve control of hypertension and diabetes among people living in the states of Kerala and Tamil Nadu	Dr Jeemon P	National Health and Medical Research Council, Australia
Social, economic and health impact of industrial pollution in Dindigul district, Tamil Nadu	Dr Srinivasan K	Indian Council of Social Science Research
Delineating the role of DNA methylation in insulin resistance driven breast cancer development and progression	Dr Srikant A	DBT
HPSR Fellowship India	Dr Rakhal Gaitonde	Forum for Health Systems Design and Transformation (HSTP)



INSTITUTE-FUNDED TDF PROJECTS (ONGOING)

Title of the Project	Principal Investigator
Design and development of a new kind of current steering electrodes with feedback for deep brain stimulator application	Mr Jithin Krishnan
Development of a cost-effective device for the isolation of autologous platelet-rich plasma for various therapeutic purposes	Dr Renjith P Nair
Reconstruction geometry optimization and methodology development using computational fluid dynamics evaluation for patient-specific vascular model acquired by MRI scanning	Mr Subhash S Nair
A suction-retractor device for aortic valve replacement in adult cardiac surgery	Dr Bineesh
Optimization of complete blood count hematology controls for use as internal quality controls in hematology analysers	Dr Anughya Bhatt
Alginate dialdehyde-gelatin as a post-surgical adhesion prevention material in thoracic surgery - A proof-of-concept study in swine models	Dr Sachin Shenoy
Indigenous bone graft expander for masquetelet-induced membrane technique	Dr Lizymol P P
Developing decellularized porcine pericardium with enhanced strength for pediatric cardiovascular application	Dr Uma Shankar
Development of mucoadhesive bandages for the treatment of desquamative gingivitis	Dr Manju
Functional near infrared spectroscopy- based brain-computer interface	Dr Sujesh Sreedharan
Augmentation of Central Analytical Facility with tests on personal protective equipment for medical use	Dr Renjith S
Pre-validation of <i>in vitro</i> hepatotoxicity test of drugs using 3D bioprinted liver construct	Dr Anilkumar P R
Development of a semi-automatic angiography system for facilitating coronary angiography and angioplasty	Mr Sarath S Nair
Home –based post-Covid physiotherapy assistance system	Mr Praveen James
Development of device for continuous non-invasive percutaneous capillary glucose measurement in children	Vishal V P
Development and evaluation of air-borne infection control system for health care facilities	Mr Shaj Upendran



INSTITUTE-FUNDED TRC PROJECTS (ONGOING)

Project Title	Principal Investigator
Development of a spinal cord stimulator for pain management	MrJithin Krishnan
Development of rapid diagnostic kit for sepsis (procalitonin-based) and <i>Chlamydia trachomatis</i>	DrManoj G

INSTITUTE-FUNDED PROJECTS (ONGOING)

Project Title	Principal Investigator	Funding
Understanding disease clustering (Multi-morbidity) in the tribal population of Kerala	Dr Jeemon	ST Grant-SCTIMST
Documenting cause of death among tribal population through automated verbal autopsy using Information and Communication Technology (ICT)	Dr Jissa V T	ST Grant-SCTIMST



COMPLETED PROJECTS

Hospital Wing & Achutha Menon Centre For Health Science Studies

Title of the Project	Principal Investigator	Funding Agency
Baseline surveillance of major risk factors of NCD in Kerala (KIRAN)	Dr Sankara Sarma	Government of Kerala
Quantitative estimation of regional brain iron deposition- a potential biomarker for Parkinson`s disease and other neurodegenerative conditions causing atypical Parkinsonism	Dr Syam K	DBT
Improving Stroke Care in India (IMPROVISE)	Dr Sylaja P N	NIHR, UK
Structural and functional imaging correlates of cognitive dysfunction in relapsing remitting multiple sclerosis	Dr Sruthi S Nair	DST
Effect of combined visual-auditory-sensory stimulation using a structured protocol in hemineglect following right hemispheric ischemic stroke: A randomized controlled trial	Dr Sajith S	Centre for Disability Studies
Molecular, clinicoradiologic and pathological characterization of oligodendrogliomas with CIC and FUBP1 mutations	Dr Deepti A N	SERB
An obligate role for Discoidin Domain Receptor 2 in cell cycle progression and apoptosis resistance in cardiac fibroblasts	Dr Neethu Mohan	DBT
Three dimensional printing in congenital heart disease	Dr Kapilamoorthy	SERB
Effectiveness of drugs control and regulating mechanism of the Drugs Control Department in Kerala State	Dr Ravi Prasad Varma	Planning Board, Government of Kerala
Availability, distribution and utilization of health care facilities in Kerala	Dr Manju R Nair	Planning Board, Government of Kerala



Biomedical Technology Wing

Title of the Project	Principal Investigator	Funding Agency
Programme support on translational research on biomaterials	Dr H K Varma, Dr Manoj Komath, Dr A Sabareeswaran	DBT
Differentiation of mesenchymal stem cells into chondrocytes by sustained delivery of miRNAs using chitosan hydrogel	Dr Prabha D Nair	SERB
MUSTER - Musculoskeletal stem cells targeting	Dr Prabha D Nair	DBT
MUSTER - Musculoskeletal stem cells targeting	Dr Harikrishna Varma	DBT
Design and fabrication of a head phantom for dosimetric evaluation of radiotherapy treatment plan	Dr Roy Joseph	KSCSTE and RCC Trivandrum
Magneto-optic sensor for cardiac biomarker detection	Dr R S Jayasree	DST
Stem cell-derived exosome therapy for clinical management of lung damage in critically-ill corona viral pneumonia patients	Dr Naresh Kasoju	SERB
Antimicrobial peptide-loaded multifunctional 3D collagen scaffold for vascularized bone tissue regeneration	Dr P V Mohanan	DST
An easy and rapid detection platform for viral diseases from saliva: COVID-19 and beyond	Dr Jayasree R S	SERB

Institute-Funded TDF Projects (Completed)

Project Title	Principal Investigator
Development of a dural substitute with mucoadhesive and antibacterial properties	Dr P Ramesh
Ceramic tile forms and tile support matrix-standardization and design considerations	Dr Francis Fernandez



Cavity conformable surgical space stent retractor(SSSR): design and proof- of-concept	Dr George C Vilanilam
Automated External Defibrillator (AED)	Ms Neethu
Design of novel polyaxial pedicle screws for thoracolumbar stabilization	Mr Aravind Kumar Prajapathi
Multi-layered wrap-knitted polyester in strengthening valve annulus after valve repair	Varghese T Panicker
Role of resting state functional magnetic resonance imaging in patients with intracranial dural arteriovenous fistula	Dr Bejoy Thomas
Assessment of carotid plaque vulnerability using 3T MRI and correlation with carotid endarterectomy	Dr Anoop.A
Role of intravoxel incoherent motion imaging (IVIM) in post transarterial chemoembolisation (TACE) response evaluation of hepatocellular carcinoma (HCC)	Dr Jineesh
The role of biomarkers in predicting the risk of hemorrhagic transformation in acute ischemic stroke	Dr Sapna Erat Sreedhran
Development of Real Time RT-PCR assay for detection of SARS-CoV2	Dr Jyothi E K

Institute-funded TRC Projects (Completed)

Project Title	Principal Investigator
Chitra Acrylosorb Respiratory Secretion Solidification System	Dr Manju S
Smart Assistive Breathing Device	Sarath S Nair
Digital Sanitization Systems	Sarath S Nair
Isolation Pods	Sarath G
Emergency Response Isolation Systems	Subhash N N
Ventilator Sharing Kit	Vinodkumar V
Examination Booth with UV disinfection system as barrier between patient and doctor	Ramesh Babu V
Disinfection Gateway for entry points at offices, hospitals, apartments, etc	Jithin Krishnan
Antibody against ASPIKE protein to prevent COVID-19	Dr Anugya Bhatt
Rapid detection kit for IgG/IgM antibody	Dr Manoj G



Nylon Flocked Swabs (Nasopharyngeal and Oropharyngeal) for COVID-19 testing	Dr Lynda Velutheril Thomas
Oropharyngeal Sample Collection Kit	Dr Anugya Bhatt
Developing a point-of-care testing protocol based on RT-LAMP for fast detection of SARS-CoV-2	Dr Anoop Kumar T
Development of a cost-effective Ventilator	Nagesh D S
Development of a Transvenous Automatic implantable Cardioverter Defibrillator System	Muraleedharan c.v
Development of aortic stent for endovascular treatment of thoracic aortic aneurysm	Dr.Sujesh .S
Development of platform technology for an implantable micro infusion pump with wireless recharging system	Sarath S.Nair
Corneal epithelial cell sheet engineering: validation and pre-clinical evaluation	Dr.Naresh Ksaoju
Hydrocephalus Shunt with flat type Adjustable Differential pressure valve design	Anoop Gopinathan
Development of bioprosthetic heart valve	Dr.Umashankar PR
Development of nitinol based Occlusions Devices of Non Surgical closure of Atrial Septal Defect	Dr.Sujesh .S
Development of Tin coated coronary stent system for treatment of coronary artery disease.	Mr.Subash N N
Development of a spinal cord stimulator for pain management	Mr Jithin Krishnan
Development of rapid diagnostic kit for sepsis (procalcitonin-based) and <i>Chlamydia trachomatis</i>	Dr Manoj G
Spinal fixation system for thoracolumbar stabilization	Mr.Arvind kumar prajpati
Development of high-strength Ti-6Al-4V (Ti-64) castings for orthopedic implants	Dr.K.G.V Sivakumar
Point of care detection of human papilloma virus using loop mediated amplification of DNA	Dr.Anoop Kumar T
Point of care diagnosis of infectious disease	Dr.Anoop Kumar T
Alginate scaffold with recombinant growth factors for enhanced wound healing	Dr.Anoop Kumar T
Development of flow diverter stent for the treatment of complex intracranial aneurysms	Dr.Sujesh .S



Institute-funded Projects (Completed)

Title of the Project	Principal Investigator	Funding
Regulation of progenitor cell function in heart by Angiotensin II	Dr Neethu Mohan	Seed Funding- SCTIMST
Intraoperative quantification of left ventricular volumes and ejection fraction by real-time three dimensional transesophageal echocardiography: Comparison with cardiac magnetic resonance imaging	Dr M S Saravana Babu	Seed Funding - SCTIMST
Identification and characterization of neuronal derived circulating exosomal miRNA and protein cargoes in Parkinson`s disease patients	Dr Madhusoodanan U K	Seed Funding - SCTIMST
AGE modification of basement membrane: Implications in neurodegenerative disease	Dr Cibir	Seed Funding - SCTIMST



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Indian Institute of Science
Bengaluru

Mr. Anil Kumar Anand

Director Technical
Microtrol Sterilisation Services Pvt. Ltd.
Mumbai

Shri. Sasi P M

Director
International Centre for Free and Open Source
Software (ICFOSS)
Thiruvananthapuram

Dr. Balasubramanian Gopalan

(Former CSO and Executive Director)
Scientific Advisor
Projects on Drug Discovery, Synthetic Chemistry &
Process Research and in Crop Protection
Hyderabad

Shri. V Sashi Kumar

Managing Director
Phoenix Medical Systems (P) Ltd.
DP42, SIDCO Industrial Estate
Chennai

Prof. Vikram Jayaram

Chair, Division of Mechanical Sciences
Indian Institute of Science
Bengaluru

Shri. A V Ramani

Group Advisor (R & D)
TTK Group of Companies
Bengaluru

Dr. Soma Guhathakurtha

SynkroMax Biotech Pvt. Ltd.
Chennai

Dr. Jyotsna Dhawan

Chief Scientist
Centre for Cellular & Molecular Biology
Hyderabad, Telangana

Dr. C N Ramchand

Chief Executive Officer
Saksin Lifesciences Pvt. Ltd.
Chennai

Dr. K P Mohan Kumar

Director
Inter University Center for Biomedical Research and
super specialty Hospital
MG University Campus, Kottayam

Dr. Manohar V Badiger

Senior Principal Scientist
Polymer Science and Engineering Division
CSIR – Pune

Shri. Ajay Pitre

Managing Partner
Pitre Business Ventures LLP
Pune

Shri. Nandakumar S

Chief Executive Officer
Perfint Healthcare Pvt. Ltd.
Chennai

**INSTITUTIONAL ETHICS
COMMITTEE****Prof. C C Kartha (Chairman)**

(Former Professor of Eminence, Molecular
Medicine & Disease Biology, RGCB)

Prof. Kala Kesavan P

Professor & Head
Department of Pharmacology
Government Medical College
Thiruvananthapuram



Prof. Pradeep S
Professor & Head
Department of Pharmacology
Dr. Somervell Memorial CSI Medical College
and Hospital (Dr. SMCSI), Karakonam P.O.
Thiruvananthapuram

Smt. Sathi Nair
Retd. Chief Secretary
TC-5/943(1), 'Samtripthi' Devapalan Nagar
Perookkada, Thiruvananthapuram

Adv. N Anand
Advocate, High Court of Kerala
II Floor, Papali Enclave, Providence Road
Providence Jn., Ernakulam

Dr. Rejnish Kumar
Additional Professor
Regional Cancer Centre (RCC)
Thiruvananthapuram

Dr. Christina George
Professor & Head
Department of Psychiatry
Dr. SMCSI Medical College, Karakonam
Thiruvananthapuram

Dr. P Manickam
Scientist E
ICMR –National Institute of Epidemiology
R127, TNBH, Ayappakkam, Chennai.

Adv. Priya Kaimal
Advocate, High Court of Kerala
C/8, V.B. Crest, St. Martin Road
Palarivattom, Ernakulam

Dr. Harikrishna Varma P R
Head, Biomedical Technology Wing
SCTIMST

Prof. Narayanan Namboodiri K K
Department of Cardiology
SCTIMST

Prof. Manikandan S
Department of Anaesthesiology
SCTIMST

Prof. Ashalatha R
Department of Neurology
SCTIMST

Prof. Biju Soman
Professor
Achutha Menon Centre for Health Science Studies
SCTIMST

Prof. Achuth Sankar S Nair (Alternate Member)
Department of Computational Biology &
Bioinformatics
University of Kerala, Karyavattom
Thiruvananthapuram

Dr. Srinivas G (Member Secretary)
Scientist G & Head
Department of Biochemistry
SCTIMST

INSTITUTIONAL ANIMAL ETHICS COMMITTEE

Dr. Anilkumar T V (Chairperson)
Scientist G (Senior Grade)
Division of Experimental Pathology
Biomedical Technology Wing
SCTIMST

Dr. P V Mohanan
Scientist G
Division of Toxicology
Biomedical Technology Wing
SCTIMST

Dr. P R Umashankar
Scientist F
Division of In Vivo Models and Testing
Biomedical Technology Wing
SCTIMST

Dr. V S Harikrishnan (Member Secretary)
Scientist E
Division of Laboratory Animal Science



Biomedical Technology Wing
SCTIMST

Dr. K R Chandramohan Nair - CPCSEA, Main Nominee

Dr. Madhavrao - Link Nominee

Dr. Murali Krishna P - Scientist from outside the Institute

Dr. Guruvayoorappan C - Socially-Aware Nominee

INSTITUTIONAL COMMITTEE FOR STEM CELL RESEARCH

Prof. Chandrabhas Narayana (Chairman)
Director
Rajiv Gandhi Centre for Biotechnology
Poojappura, Thiruvananthapuram

Prof. Shaji R V
Professor
Department of Hematology
CMC Vellore, IDA Scudder Road
Vellore, Tamil Nadu

Dr. Pradeep Kumar G
Scientist G
Reproductive Biology
Rajiv Gandhi Centre for Biotechnology
Thiruvananthapuram

Dr. C Nirmala
Professor & Head (Rtd)
Dept. of Obstetrics and Gynaecology
MCH, C-VI-L, Millanium Apartment
Jagathy, Thiruvananthapuram

Dr. Manoj Unni
Clinical Associate Professor
Clinical Hematology
Fellowship in Stem Cell Transplant
Amrita Cardio-Oncology Clinic
AIMS, Ponekkara P.O, Kochi

Smt. Sathi Nair
Rtd. Chief Secretary
TC-5/943(1), Samtripthi
Devapalan Nagar, Peroorkada
Thiruvananthapuram

Dr. K R S Krishnan
Technology Management Adviser &
Chairman Advisory Committee, NABL (India) &
Formerly, Adviser Engineering & Technology (DST)
Director (Technical & Operations) HLL Lifecare
Ltd.
4-B, Cloud Nine Apartments, Law college Jn.
PMG, Barton Hill, Thiruvananthapuram

Dr. Annie John
ICMR Emeritus Scientist
Department of Biochemistry
University of Kerala
Trivandrum

Dr. P Manickam
Scientist E
ICMR-National Institute of Epidemiology(NIE)
R 127, Ayapakkam, Chennai

Sri. Nemom V Sanjeev
Advocate, Nemom Chamber
Maharani Buildings, G K N Towers
Vanchiyoor PO, Thiruvananthapuram

Dr. Aneesh V Pillai
Assistant Professor
School of Legal Studies
Cochin University of Science and Technology
(CUSAT)
Cochin University PO, Kochi

Dr. Neethu Mohan (Member Secretary)
Scientist D
Division of Cellular and Molecular Cardiology
SCTIMST



Ms. Sreepriya C S (Co-ordinator)
Executive Secretary to the Director-cum-Ethics
Committee Co-ordinator
SCTIMST
Thiruvananthapuram

INSTITUTIONAL BIO-SAFETY COMMITTEE

Mr. C V Muraleedharan (Chairman)
Scientist G & Associate Head
Biomedical Technology Wing
SCTIMST

Dr. Kavita Raja (Biosafety Officer)
Professor
Microbiology
SCTIMST

Dr. K Madhavan Nampoothiri (DBT Nominee)
Principal Scientist (Biotechnology) &
Head, Microbial processes and Technology
(NIIST), Thiruvananthapuram

Dr. Abdul Jaleel
Scientist E-II
Rajiv Gandhi Center for Biotechnology
Thiruvananthapuram

Dr. P Ramesh
Scientist G
Biomedical Technology Wing
SCTIMST

Dr. Srinivas G
Scientist F
Department of Biochemistry
SCTIMST

Dr. Anugya Bhat
Scientist E
Thrombosis Research Unit
Biomedical Technology Wing
SCTIMST

Dr. A Maya Nandkumar (Member Secretary)
Scientist F
Division of Microbial Technology
Biomedical Technology Wing
SCTIMST

TECHNOLOGY DEVELOPMENT COMMITTEE

Dr. Sanjay Behari (Chairman)
Director
SCTIMST

Dr. P R Harikrishna Varma
Head
Biomedical Technology Wing
SCTIMST

Dr. Roy Joseph
Scientist G
Division of Polymeric Medical Devices
BMT Wing
SCTIMST

Dr. Harikrishnan S
Professor
Cardiology
SCTIMST

Dr. Bejoy Thomas
Professor
IS&IR
SCTIMST

Dr. Chitra Mandal
Professor
IICB
Kolkata

Dr. Raghu Krishnapuram
Distinguished Member of Technical Staff
IISC
Bangalore



Prof. Jayesh Bellare
Professor
Chemical Engineering
IIT Bombay
Mumbai

Dr. R Krishna Kumar
Professor
Paediatric Cardiology
AIMS, Kochi

Shri. V Sashi Kumar
MD
Phoenic Medical Systems
Chennai

BUILDING COMMITTEE

Dr. Sanjay Behari (Chairperson)
Director
SCTIMST

Dr. P R Harikrishna Varma
Head
Biomedical Technology Wing
SCTIMST

Financial Advisor (Ex-officio Convener)
SCTIMST

Dr. K P Sudheer
Executive Vice-president
Kerala State Council For Science, Technology &
Environment
Thiruvananthapuram

Mr. S J Vijaya Das
Chief Project Examiner
Kerala Infrastructure Fund Board

SENIOR STAFF SELECTION COMMITTEE

Director (Chairman - Ex-Officio)

Head
Biomedical Technology Wing

Nominee of the Secretary, DST

An expert from outside the Institute nominated by the President

Scientist nominated by the President from among the members of the Institute

Senior academic staff of the Institute not below the rank of Professor/Scientist G/Engineer G

JUNIOR STAFF SELECTION COMMITTEE

The Medical Superintendent

Head
Biomedical Technology Wing

A representative of the Academic Wing of the Institute nominated by the Director

Three Members nominated by the President

SPECIAL RESERVATION CELL

Shri. Kiran K V
Asst. Accounts Officer
F&A Division, SCTIMST

Shri. Renu Remesan
Nursing Officer – B
SCTIMST

Shri. Vinod D
Technical Assistant (Lab) –B
SCTIMST

Smt. Preethamol P
Nursing Officer –C
SCTIMST



Shri. Aji K
Physiotherapist –B
SCTIMST

INTERNAL COMPLAINTS COMMITTEE

Dr. Kavita Raja
Professor (Sr. Grade)
Department of Microbiology
SCTIMST

Dr. Bismi Gopalakrishnan
Department of Law
University of Kerala
SCTIMST

Dr. Jayasree R S
Scientist F
BMT Wing
SCTIMST

Dr. Jayadevan E R
Additional Professor
Department of Imaging Science & Interventional
Radiology, SCTIMST

Dr. Sanjay G
Additional Professor
Department of Cardiology
SCTIMST

Dr. Sapna Erat Sreedharan
Additional Professor
Department of Neurology
SCTIMST

Dr. Jissa V T
Scientist C
AMCHSS
SCTIMST

Nursing Superintendent
SCTIMST

Smt. Rosamma Manuel
Scientific Officer (MSW)
SCTIMST

PUBLIC GRIEVANCE COMMITTEE

Dr. Harikrishna Varma P R (Chairman)
Head
BMT Wing
SCTIMST

Dr. Thomas Koshy
Professor Senior Grade
Department of Anaesthesia
SCTIMST

Dr. Maya Nandakumar
Scientist G
Division of Microbial Technology
SCTIMST

Dr. Debahish Gupta
Professor
Department of Transfusion Medicine
SCTIMST

Dr. Jeemon P
Assistant Professor
AMCHSS
SCTIMST

Mr. Vipin C G
Chief Accounts Officer
SCTIMST

Smt. Sudha T
Librarian cum Information Officer
SCTIMST

Nursing Superintendent
SCTIMST

Smt. Rosamma Manuel
Jr. Scientific Officer (MSW)
SCTIMST

Administrative Officer Gr I
Hospital Wing
SCTIMST



EMPLOYEES GRIEVANCE COMMITTEE

Hospital Wing & AMCHSS

Dr. Narayanan Namboothiri (Chairman)

Professor
Department of Cardiology
SCTIMST

Dr. Srinivasan K

Professor
AMCHSS
SCTIMST

Dr. Jayadevan E R

Additional Professor
Department of Imaging Science & Interventional
Radiology, SCTIMST

Dr. Prakash Nair

Associate Professor
Department of Neurosurgery
SCTIMST

Nursing Superintendent (ex-officio)

SCTIMST

Smt. Sudha T

Librarian cum Information Officer
SCTIMST

Mr. Binu Thomas

Sr. Scientific Assistant
Anaesthesia
SCTIMST

Sri. Shibu Raj R (Convenor)

Assistant Administrative Officer
P&A Division
SCTIMST

Dr. Satheesh Nair M. (External Member)

Clinical Psychologist
Department of Health Services
Government of Kerala

BMT Wing

Dr. Manoj Komath (Chairman)

Scientist G
Division of Bioceramic Laboratory
SCTIMST

Mr. Vinodkumar V

Engineer F
Division of Extra Corporeal Devices
SCTIMST

Dr. Jayasree R S

Scientist F
Division of Biophotonics and Imaging
SCTIMST

Mr. Sajithlal M K

Engineer E
Network Service Cell
SCTIMST

Ms. Sandhya C G

Engineer E
Technology Business Division
SCTIMST

Mr. Arumugham V

Sr. Scientific Assistant (Instruments)
SCTIMST

Administrative Officer

BMT Wing (Convenor - (ex-officio))
SCTIMST

Dr. Satheesh Nair M (External Member)

Clinical Psychologist
Department of Health Services
Government of Kerala



INTERNAL COMPLAINTS COMMITTEE ON SEXUAL HARASSMENT OF WOMEN IN THE WORKPLACE (PREVENTION, PROHIBITION AND REDRESSAL) POSH ACT 2013

The Annual Report of the Internal Complaints Committee, SCTIMST, fulfils the requirements of Section 21(1) of the Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013.

1. The number of complaints of sexual harassment received in the year: 2, one from a permanent employee and other from a student
2. Number of complaints disposed of during the year: 2
3. Number of cases pending for more than 90 days: Nil
4. Number of workshops or awareness programmes against sexual harassment carried out:

Sl. No	Date	Event	Venue
1	25-11-2022	Oath taking	AMC and BMT Wing
2	01-12-2022	Webinar on the silent pandemic- AIDS by Dr Dinoop KP, Associate Professor, Microbiology	Online
3	05-12-2022	Talk on PoSH Act 2013	BMT Wing
4	08-12-2022	Talk on understanding sexual harassment, by Dr Subhasri Balakrishnan, Obstetrician and social worker, Common Health	Online

5	09-12-2022	<p>Programme- concluding of the fortnight long programmes on POSH Act 2013 on 9th Dec 2022 –</p> <ul style="list-style-type: none"> • “Redefining Women’s rights for an egalitarian society and the role of PoSH Act (in supporting women at the workplace)”. by Mr. Manoj Krishna, Professor (Retd), Govt Law College, Trivandrum, • Talk on GATI by Dr Jayashree RS, • “He for She” Panel discussion by Dr Rakhil Gaitonde, AMC and Dr Easwer HV, HOD, Neurosurgery, chaired by Dr Francis 	Hospital wing
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PROGRESS ON IMPLEMENTATION OF INTEGRITY PACT IN SCTIMST AS PER CVC REQUIREMENT.

In the year 2007, the Central Vigilance Commission vide office order dated 04.12.2007 recommended implementation of a concept called “Integrity Pact” (IP) in respect of all major procurements. The IP essentially envisages an agreement between the prospective vendors/bidders and the buyer committing the persons/officials of both the parties not to exercise any corrupt influence on any aspect of the contract. The Integrity Pact, in respect of a particular contract shall be operative from the date IP is signed by both



the parties till the final completion of the contract.

The Governing Body of SCTIMST vide its resolution No.V.37 dated 03.03.2018 recommended to incorporate Integrity Pact by, depending on the nature of procurements/contracts above a threshold value of Rupees One Crore in respect of Integrity Pact. The IP is to be implemented through Independent External Monitors (IEMs) appointed by the organization. IEMs would review independently and objectively whether and to what extent parties have complied with their obligations under the pact. The main role and responsibility of IEM is to resolve issues raised by an intending bidder regarding any aspect of the tender which allegedly restricts competition or indicates bias towards some bidders.

Accordingly SCTIMST had appointed Shri Sanjeev Behari, IRS(Retd) and Shri Sharda Prasad,IPS(Retd) both from Noida as Independent External Monitors (IEM) for implementation of Integrity pact at SCTIMST vide our letter of appointment dated 31.01.2019 for a period of three years. Subsequent to the completion of three year period of the aforesaid IEMs new IEMs namely Shri Prahlad Kumar Sinha, IP&TAFS (Retd),New Delhi and Dr Ved Prakash,ITS (Retd),Gurgaon were appointed since February'2022 for a period of three years. Both the IEMs were appointed as per the recommendation from Central Vigilance Commission (CVC) from their empanelled list.

SCTIMST had incorporated Integrity Pact in open tenders with an estimated value of more than Rs 1.00 Cr floated by SCTIMST during the financial year 2022-23. The names of the IEMs with complete contact details are incorporated in each of the Notice Inviting Tenders (NIT) of above 1.00 Cr tenders. The first meeting with the newly appointed IEMs was held on 29.11.2022.

The following were some of the agenda points discussed during the meeting with IEMs and SCTIMST.

- Generally discussed the working of the Institute, its requirements, Standards followed and existing rules and Procedures followed in the Tender

process.

- Discussed/Reviewed the Information on Tenders awarded by the institute during the financial year.
- Reviewed the compliance made by the Institute and modifications made in the system of the Institute.
- Reviewed post tender instructions as issued by CVC and its compliance.
- Reviewed the status on implementation of E-procurement and procurement through GeM.
- Discussion with Vigilance officer of the institute regarding compliance to various requirement of CVC and submission of periodical reports to CVC.
- Gave suggestions/improvements to be made in the procurement system in line with CVC guidelines from time to time.
- Conducted a session on Integrity in Governance & Preventive vigilance to the officers and staff of the institute as a part of vigilance awareness week.
- Examined the purchase process integrity of major tenders.

RESERVATION AND OTHER WELFARE MEASURES FOR SCHEDULED CASTES/ SCHEDULED TRIBES/ OTHER BACKWARD CLASSES/ ECONOMICALLY WEAKER SECTIONS AND PERSONS WITH DISABILITIES

SCTIMST has been following, in letter and spirit, the Presidential Directives and other guidelines related to reservation/concession for Scheduled Castes/ Scheduled Tribes/Other Backward Classes/



Economically Weaker Sections issued by the Government of India from time to time. An adequate monitoring mechanism has been put in place in the Institute for sustained and effective compliance with the Reservation Policy. Rosters are maintained as per the directives and are regularly inspected by the Liaison Officer to ensure compliance. A Special Reservation Cell for SC/ST employees is functioning with five members, including an Officer. In order to monitor the implementation of reservation of students admitted to various academic programs, a Student Reservation & Equal Opportunity Cell is also functioning. This Cell will address the grievances of candidates/students who belong to reservation categories on reservation related matters and ensure measures to prevent any caste based discrimination in the Institute. Cell will also monitor and implement various scholarships (International/National/State/Others) opportunities to students belong to reservation categories.

The following were the major activities by the Institute for Scheduled Castes/ Scheduled Tribes/ Other Backward Classes/ Economically Weaker Sections and Persons with Disabilities:

1. Nominated Liaison Officer for SC/ST/PWD, Liaison Officer for OBC, Liaison Officer for EWS and Liaison Officer for Ex-service Men.
2. Constitution of a five member Special Reservation Cell including one office-in-charge of the Cell
3. Implemented reservation in all temporary and project appointments above 45days.
4. Implemented reservation in Group A academic posts, laid down in the Central Educational Institutions (Reservation in Teachers' Cadre) Act, 2019 (10 of 2019) through regulation amendment vide Govt of India Gazette notification.
5. Providing Fellowship for SC/ST students.
6. Free treatment for SC/ST patients (both OP and IP) utilizing the fund received from Government of Kerala.



**SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES & TECHNOLOGY,
THIRUVANANTHAPURAM**

BALANCE SHEET AS AT 31st March 2023

CORPUS/CAPITAL FUND AND LIABILITIES		2022-23	2021-22
		Rs.	Rs.
CAPITAL FUND	1	6424791396	5701708648
RESERVES & SURPLUS	2	255904290	252139924
EARMARKED ENDOWMENT FUNDS	3	756026314	863069350
SECURED LOANS & BORROWINGS, UNSECURED LOANS & BORROWINGS, DEFERRED CREDIT LIABILITIES	4,5,6	0	0
CURRENT LIABILITIES & PROVISIONS	7	474793531	742515118
TOTAL		7911515531	7559433040
ASSETS			
FIXED ASSETS	8	2578642355	2136918128
INVESTMENTS FROM EARMARKED ENDOWMENT FUNDS	9	385143362	482316616
INVESTMENTS-OTHERS	10	255904290	252139924
CURRENT ASSETS , LOANS, ADVANCES ETC	11	4691825524	4688058372
MISCELLANEOUS EXPENDITURE (TO THE EXTENT NOT WRITTEN OFF)			
TOTAL		7911515531	7559433040
SIGNIFICANT ACCOUNTING POLICIES	24		
CONTINGENT LIABILITIES & NOTES ON ACCOUNT	25		

Sd/-
Financial Adviser

Sd/-
Director



**SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES & TECHNOLOGY,
THIRUVANANTHAPURAM**

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR 2022-23

INCOME	Schedule	2022-23	2021-22
		Total Rs.	Total Rs.
Income from Sales / Services	12	1158157127	1000355264
Grants Received from Govt of India(Salary & General)	13	2584837737	3100100000
Fees/Subscription	14	17057940	15724489
Income from Investments } Withdrawal from ERF }	15	18789833 0	14586937 0
Income from Royalty, Publication etc	16	2671343	4981543
Interest earned	17	113609666	31211419
Other Income	18	21179212	29272578
TOTAL		3916302857	4196232230
EXPENDITURE			
Establishment Expenses	20	2110259577	2106300355
Other Administrative Expenses	21	951064669	1016484341
Bank Charges	23	371592	1915089
Depreciation - Current Year		167319859	82077870
TOTAL		3229015696	3206777655
Balance being Excess Expenditure over Income (-)/Excess income over expenditure(+)		687287162	989454575
Add: Transfer to Special Reserve Account		3511476	4292268
BALANCE BEING SURPLUS CARRIED TO CAPITAL FUND		683775686	985162307

Sd/-
Financial Adviser

Sd/-
Director



**SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES & TECHNOLOGY,
THIRUVANANTHAPURAM
SCHEDULES**

SCHEDULE 1 - CORPUS/CAPITAL FUND		2022-23	2021-22
PARTICULARS		[Rs.]	[Rs.]
	Balance as at the beginning of the year	8955779849	7998550154
	Less Depreciation up to the end of the previous year	3243548478	3171993330
	Net balance at the beginning of the year	5712231371	4826556824
	Add: Grants received from Government of India for creation of Capital Assets	40835703	250000000
	Add: Grants received under CSR scheme	0	0
	Less: Unutilized Grant-in-Aid (capital)	0	250000000
	Less: Unutilized Grant-in-Aid (Revenue)	0	
	Deduct: Balance of net expenditure transferred from the Income and Expenditure Account Or add excess of income over expenditure	683775686	985162307
	Less: Value of Assets Written off during the year	12051364	110010482
	Deduct Transfer to BMT/Add Transfer from CHO	0	0
		0	0
	BALANCE AS AT THE YEAR-END	6424791396	5701708648
SCHEDULE 2-RESERVES AND SURPLUS:			
	1. Capital Reserve:		
	As per last Account	--	--
	Addition during the year	--	--
	Less: Deduction during the year	--	--
	3. Special Reserves:		
	As per last Account	252139924	244829294
	Addition during the year (Current year transfer- Increase in provision)	3764366	7310630
	Less: Deductions during the year	0	0
	4. General Reserve:		
	As per last Account	--	--
	Addition during the year	--	--
	Less: Deductions during the year	--	--
	TOTAL	255904290	252139924

Sd/-
Financial Adviser

Sd/-
Director



**SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES & TECHNOLOGY,
THIRUVANANTHAPURAM**

SCHEDULE 3-EARMARKED/ENDOWMENT FUNDS	2022-23	2021-22
a) Opening balance of the funds	863069350	877774201
b) Additions to the funds:		
i. Donations/grants	116150940	986630121
ii. Income from Investments made on account of funds		
iii. Other additions (Specify nature)	804836657	0
TOTAL (a+b)	1784056947	1864404322
c) Utilisation / Expenditure towards objective of funds		
i. Capital Expenditure		
- Fixed Assets	15603411	104412630
- Others	0	0
Total (Detailed Schedule Attached)	15603411	104412630
ii. Revenue Expenditure		
- Salaries, Wages and allowances etc.	67844152	74448052
- Rent & Consumables etc. ,	76045674	130565965
- Other Administrative expenses	868537395	691908325
Total	1012427221	896922342
TOTAL (c)	1028030632	1001334972
NET BALANCE AS AT THE YEAR-END (a+b+c)	756026314	863069350

Sd/-
Financial Adviser

Sd/-
Director



SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL
SCHEDULE 3-EARMARKED/ENDOWMENT FUNDS - AS ON 31.03.2023

PROJ #	NAME OF GRANTEE/ PRINCIPAL INVESTIGATOR	FUND-WISE BREAK UP			TOTAL	FIXED ASSETS
		OPENING BALANCE	ADDITIONS TO FUND			
			GRANTS	OTHER RECEIPTS		
	HOSPITAL PROJECTS		ADDITIONS TO FUND			
5000	PROJ-MISCELLANEOUS	9158542.28	0.00	11725984.84	20884527.12	0.00
5040	DEVELOPING EXPERIMENTAL THERAUPEUTICALS	580721.58	0.00	0.00	580721.58	136000.00
5055	ROCKFELLER FOUNDATION,USA	686120.00	0.00	0.00	686120.00	0.00
5078	PROJECT GRANT/DR MALA RAMANATHAN	5810.00	0.00	0.00	5810.00	0.00
5094	KERALA STATE AIDS CONTROL SOCIETY	650779.90	103575.00	0.00	754354.90	0.00
5100	AMC/MAC ARTHUR FOUNDATION/02-70546	46315.05	0.00	0.00	46315.05	0.00
5108	EVAL.SUB-TYPES DEMENTIA/DR.MATHURA	15800.50	0.00	0.00	15800.50	0.00
5119	STAKE HOLDER-PERCEPT/INST.REV BO	104492.73	0.00	0.00	104492.73	0.00
5133	WHO FELLOWSHIP TRAINING CBICD	215059.00	0.00	0.00	215059.00	0.00
5139	A 24 WEEK, MULTICENTER/DR. MATHURANATH	2602046.78	0.00	0.00	2602046.78	0.00
5140	HARVARD SCHOOL OF PUBLIC HEALTH	91794.32	0.00	0.00	91794.32	0.00



SCIENCES & TECHNOLOGY, THIRUVANANTHAPURAM

Amount Rs.

UTILIZATION						TOTAL EXPENDITURE	NET BALANCE
CAPITAL EXPENDITURE		REVENUE EXPENDITURE					
OTHERS	TOTAL	SALARIES/WAGES	RENT/CONSUMABLES	OTHER ADMN EXP	TOTAL		
		UTILIZATION					
0.00	0.00	0.00	0.00	14816759.42	14816759.42	14816759.42	6067767.70
0.00	136000.00	0.00	0.00	16727.00	16727.00	152727.00	427994.58
0.00	0.00	0.00	0.00	0.00	0.00	0.00	686120.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	5810.00
0.00	0.00	0.00	0.00	143799.00	143799.00	143799.00	610555.90
0.00	0.00	0.00	0.00	0.00	0.00	0.00	46315.05
0.00	0.00	0.00	0.00	0.00	0.00	0.00	15800.50
0.00	0.00	0.00	0.00	0.00	0.00	0.00	104492.73
0.00	0.00	0.00	0.00	0.00	0.00	0.00	215059.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	2602046.78
0.00	0.00	0.00	0.00	0.00	0.00	0.00	91794.32



5142	BANKING FOR BETTER HEALTH-MEDISAVE	153911.36	0.00	0.00	153911.36	0.00
5146	DEVELOPMENT OF SPECTROSCOPIC PROTOCOL	11026.00	0.00	0.00	11026.00	0.00
5150	PROTOCOL 6002-INT 001	52096.60	0.00	0.00	52096.60	0.00
5153	DEV REF. MANUAL FOR PRIMARY	155802.00	0.00	0.00	155802.00	0.00
5159	NCD RISK FACTOR SURVEILLANCE	71123.00	0.00	0.00	71123.00	0.00
5174	CHANGES IN SLEEP WAKEFULNESS-Dr.Mohanku.	49317.00	0.00	0.00	49317.00	0.00
5175	SURGICAL TRAIL IN LOBAR INTRACEREBRAL	39125.27	0.00	0.00	39125.27	0.00
5180	COMMUNITY BASED INTR- VEN-CV DIS	18308.00	0.00	0.00	18308.00	0.00
5184	COMP HEALTH CARE PROJECT ST	1040373.00	0.00	0.00	1040373.00	0.00
5190	PREVALENCE OF TYPE II DIABATES IN RURAL	42210.00	0.00	0.00	42210.00	0.00
5192	TO PROVIDE INFRASTRUCTURE TO AMCHSS	145022.50	0.00	0.00	145022.50	0.00
5193	SAFE MOTHERHOOD PROGRAMME	71796.00	0.00	0.00	71796.00	0.00
5201	OPEN LEBEL TRIAL IN PARKINSON	1247889.50	0.00	0.00	1247889.50	0.00
5203	STUDY IN MRI - ISIR	26183.00	0.00	0.00	26183.00	0.00
5209	MANAGEMENT - CORONARY EVENT	164611.00	0.00	0.00	164611.00	0.00
5213	CREATION OF AMC FUND	19693885.92	0.00	678744.00	20372629.92	0.00
5226	ISOLATION, CHARACTERIZATION OF GLIOMAS	265709.00	0.00	0.00	265709.00	0.00
5227	MONOTHERAPY/ ACTIVE CONTROL	173369.86	0.00	0.00	173369.86	0.00



0.00	0.00	0.00	0.00	0.00	0.00	0.00	153911.36
0.00	0.00	0.00	0.00	0.00	0.00	0.00	11026.00
0.00	0.00	0.00	0.00	40000.00	40000.00	40000.00	12096.60
0.00	0.00	0.00	0.00	0.00	0.00	0.00	155802.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	71123.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	49317.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	39125.27
0.00	0.00	0.00	0.00	0.00	0.00	0.00	18308.00
0.00	0.00	0.00	0.00	961208.00	961208.00	961208.00	79165.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	42210.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	145022.50
0.00	0.00	0.00	0.00	0.00	0.00	0.00	71796.00
0.00	0.00	403200.00	3900.00	267801.00	674901.00	674901.00	572988.50
0.00	0.00	0.00	0.00	0.00	0.00	0.00	26183.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	164611.00
0.00	0.00	0.00	29215.00	0.00	29215.00	29215.00	20343414.92
0.00	0.00	0.00	0.00	0.00	0.00	0.00	265709.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	173369.86



5234	IMPROVING LOCALIZATION IN LESION NEGATIVE	-2860415.00	0.00	0.00	-2860415.00	0.00
5237	KERALA DIABETES PRE-VENTION PROGRAM(K-DPP	26957.47	0.00	0.00	26957.47	0.00
5238	IMPROVING LOCALIZATION IN LESION NEGA...	4884.00	0.00	0.00	4884.00	0.00
5245	IMPROVING LOCALIZATION IN LESION N..	184938.00	0.00	0.00	184938.00	0.00
5247	A PHASE 3, 12-WEEK, DOUBLE BLIND, PLA...	1817731.85	0.00	0.00	1817731.85	0.00
5248	A PHASE 3, DOUBLE BLIND, PLACEBO AND A..	1059311.98	0.00	0.00	1059311.98	0.00
5267	EVALUATION STUDY OF THE ASHA	190689.00	0.00	0.00	190689.00	0.00
5275	ENCODING OF INTERHEMI-SPHERIC -	600557.00	0.00	0.00	600557.00	0.00
5277	VASCULAR CONGNITIVE IMPAIRMENT	39340.00	0.00	0.00	39340.00	0.00
5279	FAMILY LED REHABILITATION AFTER STROKE..	25860.00	0.00	0.00	25860.00	0.00
5284	INTERNATIONAL STUDY FOR COMPARATIVE	41387.00	0.00	0.00	41387.00	0.00
5289	MITOCHONDRIAL METABOLISM...	2232.00	0.00	0.00	2232.00	0.00
5292	A RESTING STATE FMRI & TASK ..	2282.00	0.00	0.00	2282.00	0.00
5294	MTP/EC SERVICES OF WOMEN	227053.00	0.00	0.00	227053.00	0.00
5296	ELECTROENCEPHALOGRA-PHYWORKSHOP	25230.00	0.00	0.00	25230.00	0.00
5297	THE HUMAN BRAIN MAP-PING PROJ..	2962.00	0.00	0.00	2962.00	0.00
5300	ANALYSING FUNCTIONAL NETWORKS	603761.00	0.00	0.00	603761.00	0.00



0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-2860415.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26957.47
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4884.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	184938.00
0.00	0.00	0.00	0.00	747600.00	747600.00	747600.00	747600.00	1070131.85
0.00	0.00	0.00	3763.00	0.00	3763.00	3763.00	3763.00	1055548.98
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	190689.00
0.00	0.00	199692.00	0.00	0.00	199692.00	199692.00	199692.00	400865.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	39340.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25860.00
0.00	0.00	0.00	0.00	10330.00	10330.00	10330.00	10330.00	31057.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2232.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2282.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	227053.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25230.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2962.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	603761.00



5301	IN VITRO BETA AMYLOID UPTAKE	2715.35	0.00	0.00	2715.35	0.00
5307	A RESTING FMRI	257085.00	0.00	0.00	257085.00	0.00
5310	KERALA DIABETES PREVENTION	752347.25	0.00	0.00	752347.25	0.00
5313	EQUIPMENT FOR HEART FAILURE	563776.35	0.00	0.00	563776.35	0.00
5314	NON COMMUNICABLE DISEASES	1090168.55	0.00	0.00	1090168.55	0.00
5315	PROSPECTIV SINGLE ARM MUL	793761.85	0.00	0.00	793761.85	51224.00
5317	MERES1 TRIAL A PROSPECTIVE	64965.00	0.00	0.00	64965.00	0.00
5319	ENCORE	40532.00	0.00	0.00	40532.00	0.00
5323	CHITRA DHWANI	35500.00	0.00	0.00	35500.00	0.00
5325	DECIPHERING THE GENERIC	1173899.00	0.00	0.00	1173899.00	0.00
5326	NEURO DEVELOPMENTAL DISORDERS	4438007.91	0.00	188544.00	4626551.91	51990.00
5327	MOVEMENT DISORDER	1229151.00	1159345.00	500000.00	2888496.00	0.00
5329	E-DELIVERY FOR HEALTH CARE	7409368.88	0.00	0.00	7409368.88	0.00
5332	HYPOXIA AND MINERALISATION	641.00	0.00	0.00	641.00	0.00
5336	ESTABLISHMENT OF THE INDIAN STROKE CLINICAL TRIAL NETWORK (INSTRUCT)	615466.00	0.00	0.00	615466.00	0.00
5337	SECONDARY PREVENTION BY STROKE	848520.00	0.00	0.00	848520.00	0.00
5341	SLEEP APNEA	333751.75	0.00	0.00	333751.75	0.00
5342	TRIVANDRUM HEART FAILURE	287731.00	0.00	0.00	287731.00	0.00



0.00	0.00	0.00	0.00	0.00	0.00	0.00	2715.35
0.00	0.00	0.00	0.00	100100.00	100100.00	100100.00	156985.00
0.00	0.00	320385.00	0.00	315465.00	635850.00	635850.00	116497.25
0.00	0.00	0.00	0.00	0.00	0.00	0.00	563776.35
0.00	0.00	0.00	0.00	1000000.00	1000000.00	1000000.00	90168.55
0.00	51224.00	0.00	0.00	42179.00	42179.00	93403.00	700358.85
0.00	0.00	0.00	0.00	0.00	0.00	0.00	64965.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	40532.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	35500.00
0.00	0.00	0.00	0.00	6225.00	6225.00	6225.00	1167674.00
0.00	51990.00	956257.00	94800.00	61180.00	1112237.00	1164227.00	3462324.91
0.00	0.00	0.00	239580.00	3149.00	242729.00	242729.00	2645767.00
0.00	0.00	0.00	0.00	7409368.00	7409368.00	7409368.00	0.88
0.00	0.00	0.00	0.00	0.00	0.00	0.00	641.00
0.00	0.00	92650.00	0.00	458468.00	551118.00	551118.00	64348.00
0.00	0.00	0.00	0.00	688823.00	688823.00	688823.00	159697.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	333751.75
0.00	0.00	124000.00	0.00	137300.00	261300.00	261300.00	26431.00



5343	BRAIN IRON DEPOSITION	90448.26	0.00	0.00	90448.26	0.00
5344	IMPROVEMENT OF SECONDARY	14014.00	0.00	0.00	14014.00	0.00
5345	MOBILE TELEMEDICINE PROJECT	24807730.98	0.00	0.00	24807730.98	0.00
5348	PROSPECTIVE STUDY OF PATIENTS	74888.00	0.00	0.00	74888.00	0.00
5349	FRACTIONAL FLOW REVERSE	22269.00	0.00	0.00	22269.00	0.00
5350	ICMR-THSTI FORMS	106715.00	0.00	0.00	106715.00	0.00
5354	WORKSITE BASED LIFESTYLE	2753219.00	0.00	0.00	2753219.00	0.00
5355	REGIONAL TRC FOR HEALTH ASSESSMENT	2679798.00	5000000.00	0.00	7679798.00	0.00
5356	AROYAM NETWORK (KIRAN)	14809819.00	0.00	0.00	14809819.00	0.00
5357	MOLECULAR, CLINICORADIOLOGIC AND PATHOLOGICAL CHARACTERIZATION OF OLIGODENDROGLIOMAS WITH CIC AND FUBP1 MUTATIONS (EMR/2016/005832)	88265.12	0.00	0.00	88265.12	0.00
5358	AN OBLIGATE ROLE FOR DISCOIDIN DOMAIN RECEPTOR 2 IN CELL CYCLE PROGRESSION AND APOPTOSIS RESISTANCE IN CARDIAC FIBROBLASTS	650735.48	0.00	0.00	650735.48	0.00
5361	IMPROVING STROKE CARE IN INDIA (IMPROVISE)	1946321.56	0.00	705236.00	2651557.56	0.00



0.00	0.00	0.00	0.00	0.00	0.00	0.00	90448.26
0.00	0.00	0.00	0.00	0.00	0.00	0.00	14014.00
0.00	0.00	2811258.00	0.00	265965.00	3077223.00	3077223.00	21730507.98
0.00	0.00	42000.00	0.00	0.00	42000.00	42000.00	32888.00
0.00	0.00	0.00	0.00	5249.00	5249.00	5249.00	17020.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	106715.00
0.00	0.00	852000.00	0.00	18381.00	870381.00	870381.00	1882838.00
0.00	0.00	3058165.00	0.00	1036387.00	4094552.00	4094552.00	3585246.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	14809819.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	88265.12
0.00	0.00	0.00	0.00	0.00	0.00	0.00	650735.48
0.00	0.00	8203.00	51200.00	6150.00	65553.00	65553.00	2586004.56



5362	AYURVEDIC TREATMENT IN THE REHABILITATION OF ISCHEMIC STROKE PATIENTS IN INDIA: A RANDOMIZED CONTROLLED TRIAL (RESTORE)	3261642.00	507204.00	0.00	3768846.00	0.00
5363	NATIONAL HEART FAILURE REGISTRY	4423270.37	0.00	0.00	4423270.37	0.00
5368	VIRTUAL REALITY-BASED SOLUTION FOR EFFECTIVE NEUROANATOMY TEACHING	6104246.00	300000.00	0.00	6404246.00	26971.00
5369	WORKSHOP ON BRAIN CONNECTIVITY ANALYSIS AND CONFERENCE ON BRAIN COMPUTER INTERFACE	135539.00	0.00	0.00	135539.00	0.00
5370	TRANSCRIPTIONAL AND TRANSLATIONAL REGULATION OF PERIOSTIN AND ITS INTERACTION WITH DDR2 IN CARDIAC FIBROSIS	275957.46	0.00	0.00	275957.46	0.00
5371	GENERAL ANESTHESIA VS SEDATION-COGNITIVE DECLINE IN ELDERLY – A RANDOMIZED CONTROLLED TRIAL IN PATIENTS WITH CHRONIC SUBDURAL HEMATOMA (GAS-CDE)	517676.48	0.00	31112.00	548788.48	0.00
5373	ARCHITECTURE OF PARKINSON'S	1722483.57	1392800.00	0.00	3115283.57	0.00
5374	RISK ANALYSIS OF DEMENTIA	634507.50	0.00	0.00	634507.50	0.00
5375	CARE IN HEART FAILURE	1772499.00	2940407.00	0.00	4712906.00	0.00
5376	CARE IN HEART FAILURE	1383523.24	837744.00	0.00	2221267.24	0.00
5377	CARE IN HEART FAILURE	3779483.68	646651.00	0.00	4426134.68	0.00



0.00	0.00	479452.00	76000.00	421337.00	976789.00	976789.00	2792057.00
0.00	0.00	0.00	0.00	4423270.00	4423270.00	4423270.00	0.37
0.00	26971.00	31860.00	0.00	95046.00	126906.00	153877.00	6250369.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	135539.00
0.00	0.00	0.00	31651.00	1500.00	33151.00	33151.00	242806.46
0.00	0.00	0.00	0.00	21266.00	21266.00	21266.00	527522.48
0.00	0.00	801167.00	42594.00	0.00	843761.00	843761.00	2271522.57
0.00	0.00	634508.00	0.00	0.00	634508.00	634508.00	-0.50
0.00	0.00	2328654.00	0.00	260147.00	2588801.00	2588801.00	2124105.00
0.00	0.00	271026.00	272159.00	160769.00	703954.00	703954.00	1517313.24
0.00	0.00	0.00	1134735.00	79851.00	1214586.00	1214586.00	3211548.68



5378	CARE IN HEART FAILURE	626088.00	177251.00	0.00	803339.00	0.00
5379	CARE IN HEART FAILURE	2382422.00	0.00	0.00	2382422.00	0.00
5380	CARE IN HEART FAILURE	1040038.00	0.00	0.00	1040038.00	0.00
5381	CARE IN HEART FAILURE0	1841501.00	1655968.00	0.00	3497469.00	0.00
5383	VISUAL-AUDITORY	36546.00	0.00	0.00	36546.00	0.00
5384	MAHATARI JATAN YOJANA	400000.00	0.00	0.00	400000.00	0.00
5385	QUANTITATIVE EEG AND MULTI-MO	1208417.10	0.00	0.00	1208417.10	0.00
5386	COMPREHENSIVE AND NOVEL MODEL	1125870.00	0.00	0.00	1125870.00	0.00
5387	INDUSTRIAL POLLUTION	290227.80	300000.00	0.00	590227.80	0.00
5388	EFFICIENT PORTABLE STAND	197471.00	0.00	0.00	197471.00	0.00
5389	PEDIATRIC EPILEPSY SYNDROME	183686.25	4019026.00	0.00	4202712.25	0.00
5390	HUMAN GUT MICROBIOME	851286.00	0.00	0.00	851286.00	0.00
5391	DISPOSABLE DEFIBRILLATOR	97426.00	0.00	0.00	97426.00	0.00
5392	DNA METHYLATION IN INSULIN	1170343.22	800000.00	0.00	1970343.22	0.00
5393	LIFESTYLE INTERVENTION	10910617.60	628860.00	0.00	11539477.60	0.00
5394	SKULLBASE SURGERY	56958.00	300000.00	0.00	356958.00	0.00
5395	ROLE OF CONNEXINS	1352488.24	899741.00	0.00	2252229.24	0.00
5396	ATRIAL CARDIOPATHY	97500.00	0.00	0.00	97500.00	0.00
5397	SYNUCLEINOPATHY PATHOLOGY	1374509.93	0.00	0.00	1374509.93	0.00
5398	INTERVENTIONAL THERAPY	351416.24	0.00	0.00	351416.24	0.00
5399	STROKE CARE REGISTRY	133156.00	396844.00	0.00	530000.00	0.00
5400	VISUAL OUTCOME RECURRENCE	56019.00	0.00	0.00	56019.00	0.00



0.00	0.00	0.00	0.00	39305.00	39305.00	39305.00	764034.00
0.00	0.00	0.00	0.00	192968.00	192968.00	192968.00	2189454.00
0.00	0.00	0.00	0.00	118781.00	118781.00	118781.00	921257.00
0.00	0.00	1296865.00	0.00	140771.00	1437636.00	1437636.00	2059833.00
0.00	0.00	0.00	0.00	36546.00	36546.00	36546.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	400000.00
0.00	0.00	677043.00	149340.00	141241.00	967624.00	967624.00	240793.10
0.00	0.00	91406.00	0.00	0.00	91406.00	91406.00	1034464.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	590227.80
0.00	0.00	0.00	0.00	197471.00	197471.00	197471.00	0.00
0.00	0.00	818534.00	2800000.00	255317.00	3873851.00	3873851.00	328861.25
0.00	0.00	0.00	0.00	805457.00	805457.00	805457.00	45829.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	97426.00
0.00	0.00	182667.00	0.00	128221.00	310888.00	310888.00	1659455.22
0.00	0.00	1764932.00	0.00	1255281.00	3020213.00	3020213.00	8519264.60
0.00	0.00	175935.00	94880.00	22497.00	293312.00	293312.00	63646.00
0.00	0.00	143006.00	768157.00	0.00	911163.00	911163.00	1341066.24
0.00	0.00	0.00	97500.00	0.00	97500.00	97500.00	0.00
0.00	0.00	57846.00	344418.00	0.00	402264.00	402264.00	972245.93
0.00	0.00	251720.00	37680.00	62016.00	351416.00	351416.00	0.24
0.00	0.00	335234.00	0.00	37591.00	372825.00	372825.00	157175.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	56019.00



5401	PREVENTION IN STROKE	115434.00	600000.00	0.00	715434.00	12958.00
5402	CRANIOVERTEBRAL ANOMALIES	462000.00	0.00	0.00	462000.00	0.00
5403	VIRTUAL AIRWAY ASSESSMENT	5001.00	0.00	0.00	5001.00	0.00
5404	EMOTIONAL FACE RECOGNITION	104772.00	0.00	0.00	104772.00	0.00
5405	DNA METHYLATION PROFILING	461966.68	0.00	1200000.00	1661966.68	0.00
5406	MANPOWER FOR COVID 19 TESTING UNDER NHM	0.00	628331.00	0.00	628331.00	0.00
5407	LUNG ULTRASOUND WORKFLOW	40100.00	0.00	0.00	40100.00	0.00
5408	DRUGS CONTROL	176215.00	0.00	0.00	176215.00	0.00
5410	CEREBROSPINAL FLUID	863604.59	0.00	82457.00	946061.59	0.00
5411	SYSTEM THINKING APPROACH	6687013.19	4064136.00	0.00	10751149.19	136274.00
5412	CARDIAC CHANNELOPATHIES	408974.00	2403940.00	0.00	2812914.00	0.00
5413	CHRONIC INSOMNIA	462135.00	687445.00	0.00	1149580.00	0.00
5414	AVAILABILITY, DISTRIBUTION AND	489359.00	0.00	0.00	489359.00	0.00
5415	ARTERIAL STROKE IMAGING	162478.00	0.00	0.00	162478.00	0.00
5416	IMPROVISATION (IMPROVING ST	833899.00	269942.00	0.00	1103841.00	56000.00
5417	REGULATION OF PROGENITOR CE	1219042.00	4056545.00	0.00	5275587.00	6290.00
5418	NOVEL TECHNIQUE OF DEVELOPING	68160.00	770069.00	0.00	838229.00	0.00
5419	HPSR FELLOWSHIP INDIA	324516.00	0.00	0.00	324516.00	0.00
5420	TTK CHITRA	1263560.00	2800000.00	0.00	4063560.00	0.00



0.00	12958.00	526330.00	0.00	120365.00	646695.00	659653.00	55781.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	462000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	5001.00
0.00	0.00	58000.00	21600.00	6000.00	85600.00	85600.00	19172.00
0.00	0.00	362160.00	291012.00	80877.00	734049.00	734049.00	927917.68
0.00	0.00	0.00	628331.00	0.00	628331.00	628331.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	40100.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	176215.00
0.00	0.00	465663.00	477238.00	3161.00	946062.00	946062.00	-0.41
0.00	136274.00	2564100.00	0.00	403510.00	2967610.00	3103884.00	7647265.19
0.00	0.00	817978.00	178370.00	185126.00	1181474.00	1181474.00	1631440.00
0.00	0.00	259513.00	51018.00	76776.00	387307.00	387307.00	762273.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	489359.00
0.00	0.00	64187.00	0.00	98291.00	162478.00	162478.00	0.00
0.00	56000.00	360000.00	0.00	27442.00	387442.00	443442.00	660399.00
0.00	6290.00	372000.00	1439153.00	78323.00	1889476.00	1895766.00	3379821.00
0.00	0.00	365400.00	79776.00	393053.00	838229.00	838229.00	0.00
0.00	0.00	264516.00	0.00	0.00	264516.00	264516.00	60000.00
0.00	0.00	600000.00	504622.00	750369.00	1854991.00	1854991.00	2208569.00



5421	OUTCOME DETERMINANTS OF TOF	1662111.00	372945.00	0.00	2035056.00	0.00
5422	ATRIAL CARDIOPATHY	186815.00	288537.00	0.00	475352.00	0.00
5423	CHARACTERIZATION OF UBIQUITIN	311351.00	844429.00	0.00	1155780.00	0.00
5424	HPC TOOLS	438754.00	55878.00	0.00	494632.00	14910.00
5425	HEART DISEASE REGISTRY	682668.00	0.00	0.00	682668.00	0.00
5426	EDOxaban FOR	56981.00	103202.00	0.00	160183.00	0.00
5427	PROGNOSTIC VALUE OF CIRCULATING MICRORNAs IN HEART FAILURE	1137598.00	903398.00	0.00	2040996.00	0.00
5428	EXCOA-CVT	62709.00	0.00	0.00	62709.00	55545.00
5429	TREATMENT OF IMPAIRMENT	1307890.00	500000.00	0.00	1807890.00	0.00
5430	JUGULAR VENUS SATURATION	496289.00	0.00	520794.00	1017083.00	0.00
5431	NLRP3 ACTIVATION	883943.00	1310456.00	0.00	2194399.00	0.00
5432	CLINICAL TRIAL (STROKE)	811078.00	260198.00	0.00	1071276.00	0.00
5433	MANAGEMENT OF HEART FAILURE	4455557.00	9781681.00	47820.00	14285058.00	578353.00
5434	SPIRAL DX: TREMOR DIAGNOSIS	373724.00	0.00	0.00	373724.00	0.00
5435	MULTIPLE SCLEROSIS	637020.00	467981.00	0.00	1105001.00	0.00
5436	FLUID DYNAMICS BASED TOOLS	1615236.00	1200000.00	0.00	2815236.00	680459.00
5437	NON INVASIVE MEASUREMENT	757226.00	0.00	0.00	757226.00	0.00
5438	AZADI KA AMRIT	48101.00	0.00	0.00	48101.00	0.00
5439	MOVEMENT DISORDERS (MDSI)	1470000.00	0.00	0.00	1470000.00	0.00
5440	RANDOMIZED- PLACEBO CONTROLLED	268600.00	267618.00	0.00	536218.00	0.00



0.00	0.00	316267.00	1175260.00	57538.00	1549065.00	1549065.00	485991.00
0.00	0.00	163161.00	14400.00	9173.00	186734.00	186734.00	288618.00
0.00	0.00	431520.00	152158.00	89756.00	673434.00	673434.00	482346.00
0.00	14910.00	286820.00	0.00	137024.00	423844.00	438754.00	55878.00
0.00	0.00	623798.00	0.00	25812.00	649610.00	649610.00	33058.00
0.00	0.00	50000.00	0.00	1355.00	51355.00	51355.00	108828.00
0.00	0.00	490680.00	435727.00	40294.00	966701.00	966701.00	1074295.00
0.00	55545.00	0.00	0.00	0.00	0.00	55545.00	7164.00
0.00	0.00	473133.00	92400.00	359170.00	924703.00	924703.00	883187.00
0.00	0.00	284200.00	0.00	155117.00	439317.00	439317.00	577766.00
0.00	0.00	654240.00	243199.00	46456.00	943895.00	943895.00	1250504.00
0.00	0.00	421774.00	0.00	83329.00	505103.00	505103.00	566173.00
0.00	578353.00	2146516.00	0.00	2703785.00	4850301.00	5428654.00	8856404.00
0.00	0.00	112000.00	0.00	261724.00	373724.00	373724.00	0.00
0.00	0.00	493966.00	0.00	186046.00	680012.00	680012.00	424989.00
0.00	680459.00	550064.00	0.00	124608.00	674672.00	1355131.00	1460105.00
0.00	0.00	295800.00	0.00	377049.00	672849.00	672849.00	84377.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	48101.00
0.00	0.00	0.00	0.00	6815.00	6815.00	6815.00	1463185.00
0.00	0.00	466900.00	0.00	14699.00	481599.00	481599.00	54619.00



5441	SCALEUP OF AN ADAPTED KERALA	3397248.00	3589163.00	0.00	6986411.00	0.00
5442	A PROSPECTIVE, MULTI-CENTRIC	158483.00	0.00	0.00	158483.00	0.00
5443	RETROSPECTIVE STUDY OF THE	159194.00	0.00	0.00	159194.00	0.00
5444	STROKE-SMART PHONE APPLICATION	1366586.00	0.00	0.00	1366586.00	12900.00
5445	REGISTRY ISCHEMIC STROKE	9000.00	94959.00	0.00	103959.00	0.00
5446	MITOCHONDRIAL FUNCTION	1229527.00	0.00	0.00	1229527.00	0.00
5447	A V S IYER FUND	500000.00	9501000.00	23927.00	10024927.00	0.00
5448	DONOR CHARACTERISTICS	692000.00	0.00	0.00	692000.00	0.00
5449	STROKE CLINICAL TRIAL NETWORK	3627217.00	1313572.00	0.00	4940789.00	0.00
5450	TRANSFORMING COVID-19 DATA	1313596.00	0.00	0.00	1313596.00	0.00
5451	ALGINATE DIALDEHYDE	1471000.00	0.00	0.00	1471000.00	0.00
5452	PEDIATRIC COHORT STUDY	0.00	571267.00	0.00	571267.00	0.00
5453	NO PAIN TRIAL	0.00	894699.00	0.00	894699.00	0.00
5454	ICMR RA FELLOWSHIP	0.00	257800.00	0.00	257800.00	0.00
5455	BIOMARKERS	0.00	789340.00	0.00	789340.00	0.00
5456	RENAL DISEASE	0.00	1500000.00	0.00	1500000.00	0.00
5457	COST-EFFECTIVENESS OF	0.00	504900.00	0.00	504900.00	0.00
5458	CLINICAL AND ECHOCARDIOGRAPHIC	0.00	195000.00	0.00	195000.00	0.00
5459	NEURODEVELOPMENTAL PHENOTYPES	0.00	2308504.00	0.00	2308504.00	0.00
5460	RANOLAZINE FOR HEART FAILURE	0.00	1005943.00	0.00	1005943.00	0.00



0.00	0.00	0.00	0.00	62868.00	62868.00	62868.00	6923543.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	158483.00
0.00	0.00	147000.00	0.00	0.00	147000.00	147000.00	12194.00
0.00	12900.00	499927.00	0.00	101554.00	601481.00	614381.00	752205.00
0.00	0.00	0.00	0.00	1000.00	1000.00	1000.00	102959.00
0.00	0.00	87000.00	103555.00	0.00	190555.00	190555.00	1038972.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	10024927.00
0.00	0.00	223581.00	0.00	26430.00	250011.00	250011.00	441989.00
0.00	0.00	1147787.00	261337.00	120048.00	1529172.00	1529172.00	3411617.00
0.00	0.00	191167.00	0.00	2360.00	193527.00	193527.00	1120069.00
0.00	0.00	0.00	0.00	1471000.00	1471000.00	1471000.00	0.00
0.00	0.00	499140.00	0.00	0.00	499140.00	499140.00	72127.00
0.00	0.00	171926.00	0.00	17049.00	188975.00	188975.00	705724.00
0.00	0.00	222487.00	0.00	0.00	222487.00	222487.00	35313.00
0.00	0.00	248367.00	21735.00	32986.00	303088.00	303088.00	486252.00
0.00	0.00	209420.00	0.00	178164.00	387584.00	387584.00	1112416.00
0.00	0.00	188489.00	0.00	23765.00	212254.00	212254.00	292646.00
0.00	0.00	75484.00	0.00	0.00	75484.00	75484.00	119516.00
0.00	0.00	120640.00	318142.00	128217.00	566999.00	566999.00	1741505.00
0.00	0.00	63800.00	2450.00	27843.00	94093.00	94093.00	911850.00



5461	MENTAL HEALTH CARE	0.00	2100000.00	0.00	2100000.00	0.00
5462	EMOTION PROCESSING	0.00	257800.00	0.00	257800.00	0.00
5463	MARKERS -CEREBRAL OXYGENATI ON	0.00	50000.00	0.00	50000.00	0.00
5464	GLUCOCEREBROSIDASE	0.00	950929.00	0.00	950929.00	0.00
5465	S100 PROTEINS	0.00	1193129.00	0.00	1193129.00	0.00
5466	INFRA.SPECTROSCOPY	0.00	1340306.00	0.00	1340306.00	0.00
5467	FUNCTIONAL MRI	0.00	751768.00	0.00	751768.00	0.00
5468	NOVEL GENE YANALTS IN MOYAMOYA	0.00	2004660.00	0.00	2004660.00	0.00
5469	HEART FAILURE	0.00	484306.00	0.00	484306.00	0.00
5470	COGNITIVE RETRAINING	0.00	772440.00	0.00	772440.00	0.00
5473	COGNITIVE CONSEQUENC-ES	0.00	4626164.00	0.00	4626164.00	0.00
6077	TECHNICAL ADVISORY COMMITTEE	0.00	0.00	303660.00	303660.00	0.00
6117	UNDERSTANDING DISEASE CLUST	0.00	0.00	1893468.00	1893468.00	0.00
6118	AUTOMATED VERBAL AUTOPSY	0.00	0.00	2419310.00	2419310.00	0.00
6119	CLINICAL SCORING SYS-TEMS	0.00	0.00	360678.00	360678.00	0.00
6120	GENETIC PATTERN	0.00	0.00	113500.00	113500.00	0.00
6121	REAL TIME RT-PCR ASSAY	0.00	0.00	32482.00	32482.00	0.00
6122	AIR-BORNE INFECTION	0.00	0.00	145678.00	145678.00	0.00
7101	ADVANCE TO P I	0.00	0.00	715954.00	715954.00	0.00
	Total (A)	203723675.27	91759796.00	21689348.84	317172820.11	1819874.00



0.00	0.00	41226.00	0.00	0.00	41226.00	41226.00	2058774.00
0.00	0.00	122568.00	0.00	0.00	122568.00	122568.00	135232.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	50000.00
0.00	0.00	0.00	0.00	25996.00	25996.00	25996.00	924933.00
0.00	0.00	0.00	0.00	34169.00	34169.00	34169.00	1158960.00
0.00	0.00	0.00	0.00	34086.00	34086.00	34086.00	1306220.00
0.00	0.00	0.00	0.00	21168.00	21168.00	21168.00	730600.00
0.00	0.00	0.00	0.00	57660.00	57660.00	57660.00	1947000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	484306.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	772440.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	4626164.00
0.00	0.00	303660.00	0.00	0.00	303660.00	303660.00	0.00
0.00	0.00	1302266.00	0.00	591202.00	1893468.00	1893468.00	0.00
0.00	0.00	1386426.00	0.00	1032884.00	2419310.00	2419310.00	0.00
0.00	0.00	0.00	360678.00	0.00	360678.00	360678.00	0.00
0.00	0.00	0.00	113500.00	0.00	113500.00	113500.00	0.00
0.00	0.00	0.00	32482.00	0.00	32482.00	32482.00	0.00
0.00	0.00	144000.00	1678.00	0.00	145678.00	145678.00	0.00
0.00	0.00	0.00	0.00	715954.00	715954.00	715954.00	0.00
0.00	1819874.00	41946712.00	13271393.00	49420611.42	104638716.42	106458590.42	210714229.69



	OTHER PROJECTS				0		
1014	NEW PENSION SCHEME	3068527		345605449	348673975.93		
1301	EMPLOYEES PENSION FUND	339982268		366439288	706421556.30		
1075	PATIENT WELFARE FUND	14437027		1417635	15854661.91		
1078	DR. RICHARD A CASH & DR K MOHANDS AWARD	404293		70898	475191.00		
1080	STAFF BENEVOLENT FUND	9955844		3605969	13561813.25		
1099	CSR GRANT - REVENUE	7689525			7689525.00		
	TOTAL (B)	375537484	0	717139239	1092676723	0	0

	BMT PROJECTS						
5000	PROJECT SUSPENSE	4491677.47	0.00	46793997.1	51285674.57	0.00	
5057	DYNAMIC ORTHOPAEDIC PVT LTD, HYDROXY	6787.55	0.00	0.00	6787.55	0.00	
5089	DETEC & TREAT OF CANCER BY LASER	3959.00	0.00	0.00	3959.00	0.00	
7000	MISCELLENEOUS PROJECT	30944.09	0.00	0.00	30944.09	0.00	
7001	PRO;SAHAJANAND VAS- CU;DR.AURTHUR	78108.75	0.00	0.00	78108.75	0.00	
7002	Dr.TOMS LABORATORY, Dr. K.KRISHNAN	13876.00	0.00	0.00	13876.00	0.00	
7003	PROJ:D.S.T. DR.PV. MOHANAN	2537.40	0.00	0.00	2537.40	0.00	
7004	PROJ:ATMRF:DR LISSY KRISHNAN	551.25	0.00	0.00	551.25	0.00	
7005	PROJECT:DYNAMIC ORTHOPAEDICS	13656.00	0.00	0.00	13656.00	0.00	
7006	PROJ: D.S.T. D.S.NAGESH	181074.00	0.00	0.00	181074.00	0.00	
7009	CHITOSAN BASED WAINED DRESSING	4761.75	0.00	0.00	4761.75	0.00	



				343535872	343535872.00	343535872.00	5138104
				352843553	352843553.00	352843553.00	353578003
				262254.61	262254.61	262254.61	15592407
				0	0.00	0.00	475191
				2275890	2275890.00	2275890.00	11285923
					0.00	0.00	7689525
0	0	0	0	698917570	698917570	698917570	393759154

0.00	0.00	0.00	36413902	0.00	36413902.00	36413902.00	14871772.57
0.00	0.00	0.00	0.00	0.00	0.00	0.00	6787.55
0.00	0.00	0.00	0.00	0.00	0.00	0.00	3959.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	30944.09
0.00	0.00	0.00	0.00	0.00	0.00	0.00	78108.75
0.00	0.00	0.00	0.00	0.00	0.00	0.00	13876.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	2537.40
0.00	0.00	0.00	0.00	0.00	0.00	0.00	551.25
0.00	0.00	0.00	0.00	0.00	0.00	0.00	13656.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	181074.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	4761.75



7011	DST-FAB: CLINICALLY/ SIG:SHAPE OF HEVA	213826.00	0.00	0.00	213826.00	0.00
7014	AUROLAB,ARAVIND EYE HOSPITAL	13674.00	0.00	0.00	13674.00	0.00
7015	TTK.HEALTHCARE. DEVELOPMENT OF VALV	39424.00	0.00	0.00	39424.00	0.00
7016	INDO-GERMAN COMMITTEE MEETING- DST	5407.00	0.00	0.00	5407.00	0.00
7017	HINDUSTAN LATEX.EVAL- U:BLOOD BAG	81668.53	0.00	0.00	81668.53	0.00
7018	ALL INDIA COUNCIL FOR TECHNI:EDU:SH	858285	0.00	0	858285.00	0.00
7019	DST.NIRANJAN	69847.00	0.00	0.00	69847.00	0.00
7020	IFCPAR-DR.JAYAKRISHNAN	188.00	0.00	0.00	188.00	0.00
7022	DST-LBFDPSBC-DR.SHAR- MA	79385.00	0.00	0.00	79385.00	0.00
7023	DEV: HYDRO-CEPHA- LUS-HINDUSTAN LATEX	45510.00	0.00	0.00	45510.00	0.00
7026	DEV.HEART VALVE-DST. MURALEE	2522.00	0.00	0.00	2522.00	0.00
7029	DONERG/LIFE SCIENCE BOARD	6876.00	0.00	0.00	6876.00	0.00
7031	DBT/DR P V MOHAN/DEV INVITROPYRO	79064.00	0.00	0.00	79064.00	0.00
7032	DST. DR. ANNINE/BONE REGENERATION	29166.00	0.00	0.00	29166.00	0.00
7033	BIOFUNCTIONAL EVALUA- TION DR. UMASANKER	72581.00	0.00	0.00	72581.00	0.00
7034	DST. DR. NIRMALA RACHEL	14664.00	0.00	0.00	14664.00	0.00
7035	DST-H.K.VARMA	95433.00	0.00	0.00	95433.00	0.00
7037	INVIVO EVALUATION/ STED/ DR. LISSY	6205.00	0.00	0.00	6205.00	0.00



0.00	0.00	0.00	0.00	0.00	0.00	0.00	213826.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	13674.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	39424.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	5407.00
0.00	0.00	0	5050	0.00	5050.00	5050.00	76618.53
0.00	0.00	0.00	29305.00	0.00	29305.00	29305.00	828980.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	69847.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	188.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	79385.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	45510.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	2522.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	6876.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	79064.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	29166.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	72581.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	14664.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	95433.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	6205.00



7039	JNC/ASR/DR. MOHANAN/ STUDY OF ACCUTE.....	44684.00	0.00	0.00	44684.00	0.00
7040	BIOMED/ C.V. MURALEED- HARAN	44000.00	0.00	0.00	44000.00	0.00
7041	CSIR-GRANT-ASHA S MATHEW,PHD STUDENT	55973.00	0.00	0.00	55973.00	0.00
7042	CSIR-GRANT-BERNADETTE K. MADATHIL,PHD	25870.00	0.00	0.00	25870.00	0.00
7043	CSIR-GRANT-SAILA- JA.G.S.SRF	9067.00	0.00	0.00	9067.00	0.00
7044	LISI NO TRIAL TRIAL ME- RIND	21672.65	0.00	0.00	21672.65	0.00
7045	NIRMALA RACHEL, CSIR	14063.00	0.00	0.00	14063.00	0.00
7047	U.G.C. GRANT- RESEARCH FELLOW	300935.00	0.00	0.00	300935.00	0.00
7048	CSIR GRANT- JOSENA JOSEPH	47473.00	0.00	0.00	47473.00	0.00
7049	CSIR GRANT - MARY VAR- GHESE	35837.00	0.00	0.00	35837.00	0.00
7050	INTEREST-PROJECT AC- COUNT	14022506.24	0.00	4880211	18902717.24	0.00
7051	CSIR GRANT - MANITHA B NAIR	12062.00	0.00	0.00	12062.00	0.00
7053	DR.SREENIVASAN/DEVEL. OF TEMP.RES.CO-OPLY	22619.00	0.00	0.00	22619.00	0.00
7054	DST-DR.ANOOP-DIFF:EX- PR:RAT BRAIN.....	44434.00	0.00	0.00	44434.00	0.00
7055	CSIR-NMITLI SCHEME-C.V.MURALEED- HARAN	756552.00	0.00	0.00	756552.00	0.00
7057	DST - PROJECT.DR.JAYA- BALAN	14471.00	0.00	0.00	14471.00	0.00
7060	ICMR PROJECT/ SUDHA- KAR MUTHALEE	124392.00	0.00	0.00	124392.00	0.00



0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	44684.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	44000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	55973.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25870.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9067.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21672.65
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14063.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	300935.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	47473.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35837.00
0.00	0.00	0.00	1007027.00	0	1007027.00	1007027.00	17895690.24	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12062.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22619.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	44434.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	756552.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14471.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	124392.00



7062	DR. LIZY-SAHAJA:EVA "STENT"INVITRO.....	101675.00	0.00	0.00	101675.00	0.00
7065	DR.T.V.KUMARI,DBT.BIO- GENE	38659.00	0.00	0.00	38659.00	0.00
7069	VSSC - PROJECT. D.S. NAGESH	153302.00	0.00	0.00	153302.00	0.00
7071	STEC-PROJECT: DR.MAYA NANDKUMAR	375.00	0.00	0.00	375.00	0.00
7072	SAHAJANAND MED.TECH. C.V.MURALIDHARAN	76292.00	0.00	0.00	76292.00	0.00
7074	STUDY PROJECT: CLRI- DR.MOHAN	289303.00	0.00	0.00	289303.00	0.00
7075	STUDY PROJECT - BIOSYNC SCI	11935.00	0.00	0.00	11935.00	0.00
7076	ARROW INTERNATIONAL : DR.UMASHANKAR	399773.00	0.00	0.00	399773.00	0.00
7080	DBT-DR.MAYA- TISSUE ENGINEERING HYBRID	10518.00	0.00	0.00	10518.00	0.00
7081	USV LTD. MUMBAI - DR.MOHAN	88349.00	0.00	0.00	88349.00	0.00
7082	INDO-US JOINT PROJECT	878.00	0.00	0.00	878.00	0.00
7083	ARROW HAEMO DIALYSIS	30882.00	0.00	0.00	30882.00	0.00
7085	DR.R.V.THAMPAN - CSIR	26381.00	0.00	0.00	26381.00	0.00
7087	CSIR - KALADHAR - BST	39103.00	0.00	0.00	39103.00	0.00
7092	PROJ/7092/SEA FOOD	1993.00	0.00	0.00	1993.00	0.00
7093	PROJ/7093/CSIR GRANT- LPA	50562.00	0.00	0.00	50562.00	0.00
7095	PROJ/7095/CSIR GRANT-VI- OLA.B.MORRIS	22072.00	0.00	0.00	22072.00	0.00
7097	PROJ/7097/ACCELERATED AGEING	172084.27	0.00	0.00	172084.27	0.00
7099	PROJ/7099/BCL	7011.00	0.00	0.00	7011.00	0.00



0.00	0.00	0.00	0.00	0.00	0.00	0.00	101675.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	38659.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	153302.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	375.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	76292.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	289303.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	11935.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	399773.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	10518.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	88349.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	878.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	30882.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	26381.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	39103.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	1993.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	50562.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	22072.00
0.00	0.00	0.00	31500.00	0.00	31500.00	31500.00	140584.27
0.00	0.00	0.00	0.00	0.00	0.00	0.00	7011.00



7100	PROJ/7100/ITR PRO-GRAMME	4079.00	0.00	0.00	4079.00	0.00
7101	PROJ/7101/CSIR/SONIA.T.A	2650.00	0.00	0.00	2650.00	0.00
7103	PROJ/7103/CSIR/VIDYARAJ	5682.00	0.00	0.00	5682.00	0.00
7105	PROJ/7105/CSIR/ARJUN NAMBOODIRI	26821.00	0.00	0.00	26821.00	0.00
7107	PROJ/7107/CSIR/NEENA & 2 FELLOWS	34082.00	0.00	0.00	34082.00	0.00
7108	PROJ/7108/CSIR/FRANCIS.B.FERNANDEZ	2154.00	0.00	0.00	2154.00	0.00
7110	PROJ/7110/CSIR/DEEPA.R	10919.00	0.00	0.00	10919.00	0.00
7111	PROJ/7111/CSIR/SHEEJA LIZA EASO	6353.00	0.00	0.00	6353.00	0.00
7200	JOINT PROGRAME/M.TECH	464180	0.00	0.00	464180.00	0.00
7210	PROJ/7210/CSIR/SOMA DEY	1641.00	0.00	0.00	1641.00	0.00
7220	COST OF ANIMAL FEED	4448692	0.00	818390.00	5267082.00	74800.00
7230	PROJ/7230/CSIR/MANJU.S	12421.00	0.00	0.00	12421.00	0.00
7250	PROJ/7250/CSIR/KIRAN.S.NAIR	15281.00	0.00	0.00	15281.00	0.00
7260	PROJ/7260/STOX083Y09/DR.P.V.MOHANAN	149985.00	0.00	0.00	149985.00	0.00
7290	PROJ/7290/CSIR/RAKHI.A	19584.00	0.00	0.00	19584.00	0.00
7330	Y.M.THASNEEM - UGC GRANT	7195.00	0.00	0.00	7195.00	0.00
7370	VALIDATION OF ETO STERILISATION SYSTEM-	162833.00	0.00	7768	170601.00	98749.00
7375	ICMR PROJECT- Ms. Renu Ramesh	32250.00	0.00	0.00	32250.00	0.00
7385	CSIR GRANT - CAROLINE DIANA SHERLY	1321.73	0.00	0.00	1321.73	0.00
7390	TOXICITY STUDY OF MATIRIALS Dr. P V Mohanan	4200296	0.00	2125600.00	6325896.00	0.00



0.00	0.00	0.00	0.00	0.00	0.00	0.00	4079.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	2650.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	5682.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	26821.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	34082.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	2154.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	10919.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	6353.00
0.00	0.00	0.00	0	0.00	0.00	0.00	464180.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	1641.00
0.00	74800.00	196260.00	207546.00	0.00	403806.00	478606.00	4788476.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	12421.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	15281.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	149985.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	19584.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	7195.00
0.00	98749.00	0.00	10000.00	0.00	10000.00	108749.00	61852.00
0.00	32250.00						
0.00	0.00	0.00	0.00	0.00	0.00	0.00	1321.73
0.00	0.00	0.00	1068716.00	0	1068716.00	1068716.00	5257180.00



7395	RAISNG ANTIBODIES IN RA-BITS - DR V S HARIKRISH	1588370.13	0.00	107000	1695370.13	575649.00
7400	CSIR GRANT :SHAIJU S NAZEER	3333.00	0.00	0.00	3333.00	0.00
7402	PROOF OF CONCEPT STUDY - DR UMA SHANKAR	100747.00	0.00	0.00	100747.00	0.00
7403	ICMR GRANT - PARVATHY R S	22455	0	0.00	22455.00	0.00
7404	BIOFUNCTIONAL AND HIS-TILO - DR UMA SHANKAR	761369.00	0.00	3945.00	765314.00	0.00
7405	IN VITRO EVALUATION OF CELL- DR T V KUMAR	289727.58	0.00	79706.00	369433.58	0.00
7406	CSIR GRANT - R ARATHI	6135.00	0.00	0.00	6135.00	0.00
7407	TRSF MESENCHYMAL STEM CELL	1686.00	0.00	0.00	1686.00	0.00
7409	SRUTHI PHD STUDENT UGC	9292.00	0.00	0.00	9292.00	0.00
7411	DEV POLY ADHESIVE & POTT	206140.00	0.00	0.00	206140.00	0.00
7412	REMYA K CSIR FELLOW	19900.00	0.00	0.00	19900.00	0.00
7413	"PROJ/7413/ANTIMICRO-BIAL ACTIVITY"	89585.75	0.00	0.00	89585.75	0.00
7414	"PROJ/7414/EFFECT OF NANOGRAPHENE MOUSE.."	34620.00	0.00	0.00	34620.00	0.00
7415	"PROJ/7415/AXONAL GUIDANCE"	18450.00	0.00	0.00	18450.00	0.00
7416	"PROJ/7416/PULMONARY FIBROSIS"	51023	0	0.00	51023.00	0.00
7417	"PROJ/7417/INVITRO & INVIVO EVALUATION"	352864	0	0.00	352864.00	0.00
7419	PROJ/7419/DETERMINA-TION OF TOXICITY	52516.00	0.00	0.00	52516.00	0.00



0.00	575649.00	70047.00	13586	0.00	83633.00	659282.00	1036088.13
0.00	0.00	0.00	0.00	0.00	0.00	0.00	3333.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	100747.00
0.00	0.00	0	0.00	0.00	0.00	0.00	22455.00
0.00	0.00	0.00	15000.00	0.00	15000.00	15000.00	750314.00
0.00	0.00	0.00	39210	0.00	39210.00	39210.00	330223.58
0.00	0.00	0.00	0.00	0.00	0.00	0.00	6135.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	1686.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	9292.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	206140.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	19900.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	89585.75
0.00	0.00	0.00	0.00	0.00	0.00	0.00	34620.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	18450.00
0.00	0.00	0	10685.00	0.00	10685.00	10685.00	40338.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	352864.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	52516.00



7422	PROJ/7422/HISTOPATHOLOGICAL EVALUATION	2411492.07	0.00	493350	2904842.07	23400
7423	PROJ/7423/TRACKING CARDIAC STEM	63872	0.00	0.00	63872.00	0.00
7424	PROJ/7424/SYNAPTIC PROTEOME	271.00	4986.00	0.00	5257.00	0.00
7425	PROJ/7425/BIOENGINEERED SKIN AFT FOR ...	691	0.00	0.00	691.00	0.00
7426	PROJ/7426/POLYMERIC MICRO NEEDLES	160970.46	0	0.00	160970.46	68145.00
7427	PROJ/7427/ANIONIC POLY-SAECHARIDE BASED .	3003.05	20000.00	0	23003.05	0.00
7428	PROJ/7428/BACTERIAL RESISTANCE	30292	507200	0.00	537492.00	0.00
7429	PROJ/7429/BIORESORBABLE POLYMER MESH	101326.00	0.00	0.00	101326.00	0.00
7430	PROJ/7430/TEST OF CRANIAL FIXATION	201070	0.00	0.00	201070.00	0.00
7431	PROJ/7431/SHELL NACRE	4221.00	515600	0.00	519821.00	0.00
7432	PROJ/7432/CSIR CONTINGENCY GRANT	11430.00	20000	0.00	31430.00	0.00
7433	PROJ/7433/CSIR CONTINGENCY GRANT	4161.00	20000	0.00	24161.00	0.00
7434	PROJ/7434/CSIR CONTINGENCY GRANT	766.00	8384	0.00	9150.00	0.00
7435	PROJ/7435/CSIR CONTINGENCY GRANT	11266.00	20000.0	0.00	31266.00	0.00
7436	PROJ/7436/CSIR CONTINGENCY GRANT	101.00	8384	0.00	8485.00	0.00
7437	PROJ/7437/CSIR CONTINGENCY GRANT	13767.00	16767	0.00	30534.00	0.00
7438	PROJ/7438/SCTAC2010 DRUG FORMULATION	129673.58	0	0.00	129673.58	0.00



0.00	23400.00	0.00	552330	0.00	552330.00	575730.00	2329112.07
0.00	0.00	0.00	0	0.00	0.00	0.00	63872.00
0.00	0.00	0.00	3900.00	0.00	3900.00	3900.00	1357.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	691.00
0.00	68145.00	0.00	0	0.00	0.00	68145.00	92825.46
0.00	0.00	0.00	22852	0.00	22852.00	22852.00	151.05
0.00	0.00	487200	36629.00	0.00	523829.00	523829.00	13663.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	101326.00
0.00	0.00	0.00	0.00	0	0.00	0.00	201070.00
0.00	0.00	353359.00	15930	0.00	369289.00	369289.00	150532.00
0.00	0.00	0.00	20623	0.00	20623.00	20623.00	10807.00
0.00	0.00	0.00	16107	0.00	16107.00	16107.00	8054.00
0.00	0.00	0.00	0	0.00	0.00	0.00	9150.00
0.00	0.00	0.00	2000	0.00	2000.00	2000.00	29266.00
0.00	0.00	0.00	0	0.00	0.00	0.00	8485.00
0.00	0.00	0.00	30534	0.00	30534.00	30534.00	0.00
0.00	0.00	0.00	0	0.00	0.00	0.00	129673.58



7439	CSIR CONT.GRANT/MEDHA-SURENDRANATH	998	20000	0.00	20998.00	0.00
7440	CSIR CONT.GRNAT/MANJULA P M	18356	0	0.00	18356.00	0.00
7441	PROJ/7441/THERMORE-SPONSIVE POLYMERIC	115410.00	0	201700.00	317110.00	0.00
7442	PROJ/7442/RAPID PROTOTYPING FACILITY	142809.00	0	0.00	142809.00	0.00
7443	PROJ/7443/MATRIX GEL(CHOLEGEL)	17177.00	411158	0.00	428335.00	0.00
7444	PROJ/7444/DIABETIC FOOT ULCER	69944.00	0	0.00	69944.00	0.00
7445	PROJ/7445/RIGID KNEE BRACE	40485.00	0	0.00	40485.00	0.00
7446	PROJ/7446/FAST RESORBING CERAMIC	20000.00	0	0.00	20000.00	0.00
7447	PROJ/7447/BIOMINERAL BASED SELF-SETTING	180227.00	114253	0.00	294480.00	0.00
7448	PROJ/7448/STRUCTURAL PERFORMANCE ASSES..	65304.00	0	0.00	65304.00	0.00
7449	"PROJ/7449/SHORT COIR FIBER"	33120.00	0.00	0.00	33120.00	0.00
7450	"PROJ/7450/HYBRID COATINGS"	12174.00	0.00	0.00	12174.00	0.00
7451	"PROJ/7451/EFFECTS OF BACOPA MONNIERI ..."	101872.00	0.00	0.00	101872.00	0.00
7452	"PROJ/7452/ANTI-MICROBIAL ACTIVITY"	134374.00	48000	0.00	182374.00	0.00
7453	PROJ/7453/LIVER SCAFFOLDS	0.00	20000	0.00	20000.00	0.00
7454	PROJ/7454/NANOSENSITIZERS	235760.00	431520	0.00	667280.00	0.00
7455	PROJ/7455/RAPID DIAGNOSTIC KIT	48034.00	0	0.00	48034.00	32400.00



0.00	0.00	0.00	20998	0.00	20998.00	20998.00	0.00
0.00	0.00	0.00	0	0.00	0.00	0.00	18356.00
0.00	0.00	0.00	5950	0.00	5950.00	5950.00	311160.00
0.00	0.00	72090.00	45684	0.00	117774.00	117774.00	25035.00
0.00	0.00	0.00	0	0.00	0.00	0.00	428335.00
0.00	0.00	0.00	0	0.00	0.00	0.00	69944.00
0.00	0.00	20000.00	0	0.00	20000.00	20000.00	20485.00
0.00	0.00	0.00	0	0.00	0.00	0.00	20000.00
0.00	0.00	274480.00	14476	0.00	288956.00	288956.00	5524.00
0.00	0.00	0.00	27686	0.00	27686.00	27686.00	37618.00
0.00	0.00	0.00	3000	0.00	3000.00	3000.00	30120.00
0.00	0.00	0.00	0	0.00	0.00	0.00	12174.00
0.00	0.00	57600.00	42606	0.00	100206.00	100206.00	1666.00
0.00	0.00	0.00	126824	0.00	126824.00	126824.00	55550.00
0.00	0.00	0.00	18762	0.00	18762.00	18762.00	1238.00
0.00	0.00	647280.00	1770	0.00	649050.00	649050.00	18230.00
0.00	32400.00	0.00	0	0.00	0.00	32400.00	15634.00



7456	"PROJ/7456/EVALUATION STUDIES OF DTRT"	700000.00	0	0.00	700000.00	0.00
7457	"PROJ/7457/BIODEGRADABLE ORTHOTIC WRIST"	0.00	1296000	0.00	1296000.00	0.00
7458	PROJ/7458/CSIR CONTINGENCY	0.00	20000	0.00	20000.00	0.00
7459	"PROJ/7459/SANDWICH IMMUNOSENSOR"	0.00	429667	0.00	429667.00	0.00
7460	PROJ/7460/DRUG EFFICACY	0.00	477645	0.00	477645.00	0.00
7461	"PROJ/7461/TECHNOLOGY CONCLAVE 2022"	0.00	0	3823267.00	3823267.00	0.00
7462	PROJ/7462/DEW-2022	0.00	0	926042.00	926042.00	0.00
7463	PROJ/7463/CHITRA JOURNAL	0.00	20580	0.00	20580.00	0.00
8004	PROJ/8004/PROGRAM SUPPORT & TISSUE	-278345.00	0.00	0.00	-278345.00	0.00
8005	PROJ/8005/PROGRAM SUPPORT & TISSUE	-98722.00	0.00	0.00	-98722.00	0.00
8006	PROJ/8006/BIOCONJUGATION NANO MAT.	139019.00	0.00	0.00	139019.00	0.00
8008	PROJ/8008/CSIR GRANT-PADMAJA.P.NAMBI	12990.00	0.00	0.00	12990.00	0.00
8009	PROJ/8009/DBT/DR.T.V.ANILKUMAR/DE...TISSUE	-310641.00	0.00	0.00	-310641.00	0.00
8011	PROJ/8011/NANOFRONT/DR.NIRANJAN/INTRAMAS	139900.00	0.00	0.00	139900.00	0.00
8012	PROJ/8012/VSSC/DR.NIRANJAN/DESIGN STUDIES	2148623.00	0.00	0.00	2148623.00	0.00
8015	PROJ/8015/DR.ANOOPKUMAR/PROGRAMME...	12581.00	0.00	0.00	12581.00	0.00
8020	PROJ/8020/CSIR/DR.LISSY KRISHNAN	19974.36	0.00	0.00	19974.36	0.00



0.00	0.00	0.00	35000	0.00	35000.00	35000.00	665000.00
0.00	0.00	154684.00	53566	0.00	208250.00	208250.00	1087750.00
0.00	0.00	0.00	19627	0.00	19627.00	19627.00	373.00
0.00	0.00	413000.00	10572	0.00	423572.00	423572.00	6095.00
0.00	0.00	411000.00	0	0.00	411000.00	411000.00	66645.00
0.00	0.00	0.00	2910337	0.00	2910337.00	2910337.00	912930.00
0.00	0.00	0.00	820042	0.00	820042.00	820042.00	106000.00
0.00	0.00	0.00	0	0.00	0.00	0.00	20580.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	-278345.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	-98722.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	139019.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	12990.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	-310641.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	139900.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	2148623.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	12581.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	19974.36



8021	PROJ/8021/ANGIOGENESIS EXP/DR.UMASHANKAR	79036.00	0.00	0.00	79036.00	0.00
8023	PROJ/8023/KSCSTE/ DR.H.K.VARMA	76545.00	0.00	0.00	76545.00	0.00
8024	PROJ/8024/IIT/DR.PR.ANIL- KUMAR	2935.00	0.00	0.00	2935.00	0.00
8026	PROJ/8026/	3339.00	0.00	0.00	3339.00	0.00
8027	PROJ/8027/DR.PV.MOHAN- AN	79732.00	0.00	0.00	79732.00	0.00
8028	PROJ/8028/DR.DIKSHA PAINULY	22332.00	0.00	0.00	22332.00	0.00
8031	PROJ/8031	-309053.00	0.00	0.00	-309053.00	0.00
8032	PROJ/8032/O.S.N.NAIR	128471.00	0.00	0.00	128471.00	0.00
8034	PROJ/8034/FLURO PASSI... DR.ROY JOSEPH	679576.1	0.00	0.00	679576.10	0.00
8035	PROJ/EVALN OF SEWING RING-DR.UMASHANKAR	18801.00	0.00	0.00	18801.00	0.00
8038	PROJ/DEV OF MISSION PROGRAM - DR.GSB	1182223.00	0.00	0.00	1182223.00	0.00
8040	PROJ/SYNTHESIS OF OX- IDE-DR.H.K.VARMA	1475.00	0.00	0.00	1475.00	0.00
8046	PROJ/DIFF. OF ADULT PRO - DR.ASHA.S.MATHEW	739755.00	0.00	0.00	739755.00	0.00
8049	PROJ/NEW VISION BIO- MAT-DR.C.P.SHARMA	13271.00	0.00	0.00	13271.00	0.00
8059	PROJ/CELL SHEET EN- GG-DR.PR.ANILKUMAR	108000.00	0.00	0.00	108000.00	0.00
8062	PROJ/ACCELERATED ARE- ING../MR.C.V.MURALI	213728.00	0.00	0.00	213728.00	0.00
8064	NONVIRAL GENE DELIVERY VECTORS- DR.REKHA	33801.00	0.00	0.00	33801.00	0.00



0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	79036.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76545.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2935.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3339.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	79732.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22332.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-309053.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	128471.00
0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	679576.10
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18801.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1182223.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1475.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	739755.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13271.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	108000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	213728.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	33801.00



8068	INSPIRE RESEARCH PROJECT -DR.BINDU.PNAI R	3957.00	0.00	0.00	3957.00	0.00
8069	PROJ/8069/STUDIES BIO-DEGRADABLE	1425.00	0.00	0.00	1425.00	0.00
8070	PROJ/8070/PINSPIRE FACULTY AWARD-DR.SHIV	472880.65	0.00	0.00	472880.65	0.00
8071	PROJ/8071/REGEN .OF INTERVERTEBRAL DISC	5840.00	0.00	0.00	5840.00	0.00
8072	PROJ/8072/NANO CALCIUM PHOSPHATE	15412.10	0.00	0.00	15412.10	0.00
8074	PRODUCTION OF NOVEL NANO INDO-UK DR.CPS	303180.00	0.00	0.00	303180.00	0.00
8077	HOME BASED VITAL SIGNS - DR.NIRANJAN.D.	204509.75	0.00	0.00	204509.75	0.00
8079	DOSE RANGING STUDY FOR DES / DR.SABAREES	731710.00	0.00	0.00	731710.00	0.00
8082	ASSESSMENT OF CERAM-ICCONSTRUCTS - FRANC	37118.00	0.00	0.00	37118.00	0.00
8083	IN VITRO OSTEOARTHRIC-ITIC-DR.NEETHUMOHAN	8294.82	0.00	0.00	8294.82	0.00
8086	PROJ/8086/GOLD NANORODS FOR THERAPY	18626.77	0.00	0.00	18626.77	0.00
8087	PROJ/8087/CONTROLLED DELIVERY	26580.86	0.00	0.00	26580.86	0.00
8090	INSPIRE FELLOW PHD KEERTHI S JRF	413206	0	0.00	413206.00	0.00
8094	ALTERNATE	902.02	0.00	0.00	902.02	0.00
8095	DEV RAPID UTI DR. MAYA - DST	8173.15	0.00	0.00	8173.15	0.00
8097	MULTIFUNCN - DBT SUNITHA PREM	223322.22	0.00	0.00	223322.22	0.00
8098	HOW ACTIN FILAMENT STRUCTUDR RENU MOH	1129.00	0.00	0.00	1129.00	0.00



0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3957.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1425.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	472880.65
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5840.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15412.10
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	303180.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	204509.75
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	731710.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	37118.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8294.82
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18626.77
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26580.86
0.00	0.00	389760	0.00	0.00	389760.00	389760.00	0.00	23446.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	902.02
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8173.15
0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	223322.22
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1129.00



8102	"ENGINEERING BIOMIMETIC.... NICHE TARA.S"	54224.75	0.00	0.00	54224.75	0.00
8106	PROJ/8106/MECHANISM OF ANGIOGENESIS	0	18301	0.00	18301.00	0.00
8107	"PROJ/8107/DEFINING MECHANO-BIOLOGY TO HETEROGENEITY IN MUSCLE STEM-BIOLOGY"	1149415.52	0	64335.00	1213750.52	0.00
8108	"PROJ/8108/Development Of A Dental Restorative Material Based On Inorganic Hybrid Resin OF A DENTAL RES..."	44556.45	0.00	0.00	44556.45	0.00
8113	"PROJ/8113/TREATMENT OF BONE DEFECTS"	139800.00	0.00	0.00	139800.00	0.00
8114	"PROJ/8114/NANO PARTICLES WITH CELLS"	27733.17	0	0.00	27733.17	0.00
8115	PROJ/8115/TECHNOLOGY RESEARCH CENTRE	36188722.57	0.00	76417436.53	112606159.10	5692693.00
8116	"PROJ/8116/Program support of Translational research on Bio materials for orthopaedics and Dental applications SUPPORT ON TRAN..."	292646.71	0	0.00	292646.71	0.00
8117	"PROJ/8117/Gold Nanorod Based Targeted nanoprobe for cancer theranostics: Diagnosis by surface Enhanced Raman Scattering (SERS) and Fluorescence imaging and therapy by PDT and PPT BASED TARGETED"	10371.19	0	0.00	10371.19	0.00



0.00	0.00	0.00	0.00	0.00	0.00	0.00	54224.75
0.00	0.00	0.00	0	0.00	0.00	0.00	18301.00
0.00	0.00	1004032.00	18900.00	0.00	1022932.00	1022932.00	190818.52
0.00	0.00	0.00	0.00	0.00	0.00	0.00	44556.45
0.00	0.00	0.00	0.00	0.00	0.00	0.00	139800.00
0.00	0.00	0.00	27675.00	0.00	27675.00	27675.00	58.17
0.00	5692693.00	2039766.00	3916694.00	100957006.1	106913466.10	112606159.10	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	292646.71
0.00	0.00	0.00	0.00	0.00	0.00	0.00	10371.19



8124	PROJ/8124/DEV. OF AORTIC STENT GRAFT	3100868.36	250000.00	-2155022.36	1195846.00	0.00
8125	PROJ/8125/DEV. OF DEEP BRAIN STIMULATOR	1727212.99	0.00	-1727212.99	0.00	0.00
8126	PROJ/8126/CARDIOVERTER DEFIBRILLATOR	7409327.94	0.00	-6540264.94	869063.00	112035.00
8128	PROJ/8128/DEPT.OFANNU-LOPLASTY./MITRALVALVE-CORRECTION	4078201.80	0.00	-4058401.80	19800.00	0.00
8129	PROJ/8129/DEVPT.OF BIO-PROSTHETICHEART VALVE	3476337.77	0.00	-2218542.77	1257795.00	0.00
8134	PROJ/8134/HYDROCEPHALUS SHUNT	5490037.00	620000.00	-4550504.00	1559533.00	937685.00
8135	PROJ/8135/STANDARDIZATION OF ALBUMIN	739723.80	0.00	-491923.80	247800.00	0.00
8137	PROJ/8137/3D PRNTNG OF SKIN TISSUE CONSTRUCTS FOR IN-VIRTO TESTING&APPLICATIONS	804108.68	0.00	-452128.68	351980.00	164313.00
8138	PROJ/8138/DEVLPMNT OF PLATFORM TECLGY IMPLATABLE MICRO INFUSION RECHRGING SYSTEM	1073507.72	0.00	-1001633.72	71874.00	0.00
8139	PROJ/8139/PARYLENE COATING FOR IMPLANTABLE MEDICAL DEVICES& DELIVERY SYSTEM	556872.88	0.00	-556872.88	0.00	0.00
8146	PROJ/8146/POINT OF CARE DETECTION	1147374.75	1000000.00	-1735475.75	411899.00	0.00
8147	PROJ/8147/POINT OF CARE DIAGNOSIS	878290.05	1500000.00	-2372679.05	5611.00	0.00
8148	PROJ/8148/ALGINATE SCAFFOLD	640139.09	253362.00	-451397.09	442104.00	0.00
8150	PROJ/8150/DEV. OF OCCLUSION DEVICE	355927.74	280000.00	-219318.74	416609.00	0.00



0.00	0.00	475757.00	720089.00	0.00	1195846.00	1195846.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	112035.00	195414.00	561614.00	0.00	757028.00	869063.00	0.00
0.00	0.00	19800.00	0.00	0.00	19800.00	19800.00	0.00
0.00	0.00	329438.00	928357.00	0.00	1257795.00	1257795.00	0.00
0.00	937685.00	621848.00	0.00	0.00	621848.00	1559533.00	0.00
0.00	0.00	0.00	247800.00	0.00	247800.00	247800.00	0.00
0.00	164313.00	0.00	187667.00	0.00	187667.00	351980.00	0.00
0.00	0.00	71874.00	0.00	0.00	71874.00	71874.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	327600.00	84299.00	0.00	411899.00	411899.00	0.00
0.00	0.00	0.00	5611.00	0.00	5611.00	5611.00	0.00
0.00	0.00	0.00	442104.00	0.00	442104.00	442104.00	0.00
0.00	0.00	310664.00	105945.00	0.00	416609.00	416609.00	0.00



8152	PROJ/8152/DEVELOPMENT OF TITANIUM NITRATE COATED CORONARY STENT	1814679.65	410680.00	-936340.65	1289019.00	0.00	
8155	PROJ/8155/DEVPT.OF FLOW DIVERTERTREATMENT OFANEURYSMS	1813801.24	300000.00	-1587033.24	526768.00	0.00	
8157	PROJ/8157/DEVLPMT OF PLRS&HIGH STAKE DECE- SION MKNG FROM CON- CEPT PDT	347545.00	360000.00	-428965.00	278580.00	0.00	
8158	PROJ/8158/PRIMER TECH- NOLOGY TNFR TECHN- ICAL,MKT,FINICIAL,CL,RE- GLURTY INPUTS	13684.30	108000.00	-121684.30	0.00	0.00	
8160	PROJ/8160/TOXICOLOGI- CAL EVALUATION	1197036.90	656000.00	-1214878.90	638158.00	0.00	
8161	PROJ/8161/LARGE ANIMAL EVALUATION	6282678.05	219000.00	-5465246.05	1036432.00	0.00	
8162	PROJ/8162/BLOOD COM- PATIBILITY	172218.60	304000.00	-90193.60	386025.00	65454.00	
8163	PROJ/8163/CYTOCOMPAT- IBILITY	713805.20	0.00	-713805.20	0.00	0.00	
8164	PROJ/8164/HYTOPATHO- LOGICAL EVALUATION	351652.52	0.00	-351652.52	0.00	0.00	
8165	PROJ/8165/MICROBIOLOGI- CAL EVALUATION	91120.34	0.00	-91120.34	0.00	0.00	
8166	PROJ/8166/ANALYTICAL CHARACTERISATION	875857.60	0.00	-875857.60	0.00	0.00	
8167	PROJ/8167/DESIGN & PRO- TOTYPING	237517.60	926000.00	-228709.60	934808.00	0.00	
8171	PROJ/8171/ENTERIC COAT- ING & MICRO INCAPSULA- TION OF ANTIBODIES	8806.4	0.00	0.00	8806.40	0.00	



0.00	0.00	303986.00	985033.00	0.00	1289019.00	1289019.00	0.00
0.00	0.00	305898.00	220870.00	0.00	526768.00	526768.00	0.00
0.00	0.00	278580.00	0.00	0.00	278580.00	278580.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	508394.00	129764.00	0.00	638158.00	638158.00	0.00
0.00	0.00	168240.00	868192.00	0.00	1036432.00	1036432.00	0.00
0.00	65454.00	320571.00	0.00	0.00	320571.00	386025.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	907769.00	27039.00	0.00	934808.00	934808.00	0.00
0.00	0.00	0.00	0	0.00	0.00	0.00	8806.40



8173	PROJ/8173/BLOOD DRAIN AREA TARGETED NANO CONSTRUCTS FOR DIAGNOSIS OF BRAIN DISEASES & DELIVERY OF THERAPEUTICS INTO THE BRAIN	3463.23	0.00	0.00	3463.23	0.00
8175	PROJ/8175/MUSTER- MUSCULOSKELETAL STEM CELL TARGETING	1656571.74	0.00	0	1656571.74	0.00
8176	PROJ/8176MUSTER- MUSCULOSKELETAL STEM CELL TARGETING	645128.18	0.00	150687.00	795815.18	0.00
8178	PROJ/8178/PRECLINICAL EVALUATION & COMMERCIALISATION ANTI SNAKE VENOM (IGY)	55086.9	0.00	0.00	55086.90	0.00
8179	PROJ/8179/DEVELOPMENT OF NOVEL PROTOTYPE MECHANICAL PLOT RETRIEVER FOR TREATMENT OF ACUTE CEREBRAL ISCHEMIC STROKE	281434.75	0.00	0.00	281434.75	0.00
8180	PROJ/8180/TO MODEL THE EFFECT OF MUTATION OF HCN CHANNELS IN NEURONAL EXITABILITY AND IMPACT OF GABABR ON GIRK AND HCN MUTATION USING NEURON	43768	0	0	43768.00	0.00
8182	PROJ/8182/A TISSUE ENGINEERED SKIN SUBSTITUTE WITH LOCALISED HAIR FOLICLE STEM CELLS FOR HAIR FOLICLES AND SEBACIOUS GLAND REGENERATION	32075.04	0.00	217	32292.04	0.00



0.00	0.00	0.00	0.00	0.00	0.00	0.00	3463.23
0.00	0.00	0.00	594028.00	0.00	594028.00	594028.00	1062543.74
0.00	0.00	0.00	0.00	0.00	0.00	0.00	795815.18
0.00	0.00	0	0.00	0.00	0.00	0.00	55086.90
0.00	0.00	0.00	0.00	0.00	0.00	0.00	281434.75
0.00	0.00	0.00	0.00	0	0.00	0.00	43768.00
0.00	0.00	0.00	0	32292	32292.00	32292.00	0.04



8183	PROJ/8183/BIO ENGI-NEERED CONSTRUCT WITH CARDIAC MESENCHYMAL CELLS FOR MYOCARDIAL REPAIR	18408.53	1903592	497.00	1922497.53	0.00
8185	PROJ/8185/BLOOD BRAIN BARRIER PERMEABLE NANOCARRIERS FOR DIAGNOSIS7THERAPY OF NEURO GENERATIVE DISEASES	1958328.27	0.00	333.00	1958661.27	0.00
8186	PROJ/8186/3D PRINTED CELL FREE BIPHASIC MA-TRICCES LOADED WITH AN ADMIXTURE OF BIOMOL-ECULES FOR ENHANCED PROGENITOR CELL	37075	75756	0.00	112831.00	0.00
8187	PROJ/8187/DEVELOPMENT OF HUMAN-ON-A-CHIP DEVICE TECHNOLOGY	2518113.38	0.00	0.00	2518113.38	0
8188	PROJ/8188/EXPERT ADVI-SORY GROUP	300114.00	0.00	0.00	300114.00	0.00
8189	PROJ/8189/CARE IN heart failure NT pro BNP POC DEVICE	3597530.25	0	0.00	3597530.25	0
8190	PROJ/8190/MAGNETO-optic sensor for cardiac biomarker detection.	169219.67	0	0.00	169219.67	0
8191	PROJ-8191:INDO-JA-PAN-ANTI -MICROBIAL peptide(II37) loaded multi-functional	202000.00	0	0.00	202000.00	0
8192	PROJ/8192/B277:B282EX-TENDING BENEFITS OF BIO-MEDICAL SCIENCE &TECH TO ST COMPONENTS	9810289.51	0.00	254444.00	10064733.51	4851276.00



0.00	0.00	1422000.00	124615.00	497.00	1547112.00	1547112.00	375385.53
0.00	0.00	878400.00	894273.00	102588.00	1875261.00	1875261.00	83400.27
0.00	0.00	0	0.00	0.00	0.00	0.00	112831.00
0.00	0.00	169103.00	588738.00	718400.00	1476241.00	1476241.00	1041872.38
0.00	0.00	0.00	0.00	0.00	0.00	0.00	300114.00
0.00	0.00	15707.00	251168.00	61666.00	328541.00	328541.00	3268989.25
0.00	0.00	0.00	0	0.00	0.00	0.00	169219.67
0.00	0.00	0.00	0	0.00	0.00	0.00	202000.00
0.00	4851276.00	3702099.00	124871.00	1192969.00	5019939.00	9871215.00	193518.51



8193	PROJ/8193/EXTENDING BENEFITS OF BIOMEDICAL SCIENCE &TECH TO SC COMPONENTS	4067337.81	0.00	135652.00	4202989.81	1070106.00
8194	PROJ/8194/STEM CELL DERIVED EXOSOMETHERAPY FOR CLINICAL MGT OF LUNG DAMAGEIN CRITICALLY ILL CORONA VIRAL PNEUMONIA PATIENTS	194893.82	93703.00	0.00	288596.82	0.00
8195	"PROJ/8195/AN EASY 7RAPID DETECTION PLATFORM FOR VIRAL DISEASES FROM SALIA"	503296.71	0.00	20887.00	524183.71	0.00
8196	"PROJ/8196/DEVPT OF MODIFIED GLASS IONOMER CEMERT TO IMPROVE MECHANICAL PROPERTIES"	238372.00	500000.00	7188.00	745560.00	0.00
8197	"PROJ/8197/PURDUE UNIVERSITY OVERSEASES VISITING DOCTORAL FELLOWSHIP"	0.00	187200.00	0.00	187200.00	0.00
8198	"PROJ/8198/EFFICACY EVALUATION OF 3D BIOPRINTED LIVER CONSTRUCTS ESTABLISED FROM NICHE SPECIFIC BIOINIK&STEMCELL DERIVED HEPATOCYTE LIKE CELL"	205613.00	1300000.00	5552.00	1511165.00	0.00
8199	PROJ/8199/DESIGN AND DEVPT OF A MICRO DIALYSIS SET-UP FOR CEREBRAL APPLICATIONS	1243722.00	0.00	43810.00	1287532.00	0.00
8200	"PROJ/8200/GENDER ADVANCEMENT FOR TRANSFORMING INSTITUTIONS"	39554.00	0.00	1204.00	40758.00	0.00



0.00	1070106.00	2334072.00	292714.00	506097.00	3132883.00	4202989.00	0.81
0.00	0.00	0.00	0.00	288596.00	288596.00	288596.00	0.82
0.00	0.00	0.00	284233.00	0.00	284233.00	284233.00	239950.71
0.00	0.00	389644.00	160760.00	50000.00	600404.00	600404.00	145156.00
0.00	0.00	187200.00	0.00	0.00	187200.00	187200.00	0.00
0.00	0.00	129445.00	296582.00	100000.00	526027.00	526027.00	985138.00
0.00	0.00	380305.00	305573.00	601654.00	1287532.00	1287532.00	0.00
0.00	0.00	0.00	16690.00	23078.00	39768.00	39768.00	990.00



8201	"PROJ/8201/DEVPT OF PLASTICIZER FREE ACRYLIC DENTURE SOFT LINERS USING NANOGELADDITIVES"	990706.00	0.00	22348.00	1013054.00	0.00
8202	"PROJ/8202/DEVPT OF PEDICLE SCREW BASED DYNAMIC STABILIZATION SYSTEMS FOR DEGENERATIVES DISEASES OF LUMBOSACRAL SPINE"	987200.00	0.00	11872.00	999072.00	0.00
8204	PROJ/8204/SYNTHESIS AND CHARACTERISATION OF Zn-Fe LAYERED DOUBLE HYDROXIDE 3D SCAFFOLD LOAED WITH ANTI-INFLAMMATORY PEPTIDE	0.00	1065600.00	0.00	1065600.00	0.00
8205	"PROJ/8205/NATIONAL TRANSLATIONAL RESEARCH FACILITY FOR BIOMATERIAL&DEVICE&INVITRO DIAGNOSTICS"	84795200.00	0.00	288001.00	85083201.00	0.00
8207	PROJ/8207/ALGINATEDI-ALEHHYDE-GELATIN AS APOST SURGICAL ADHESION PREVENTION MATERIAL IN CARDIC SURGERY SWINE	0.00	1471000.00	0.00	1471000.00	0.00
8208	PROJ/8208/DESIGNER SMALL DIAMETER VASCULAR GRAFTS FOR REDUCED NEOINTIMAL HYPERPLASIA THROUGH	0.00	843000.00	0.00	843000.00	0.00
8209	PROJ/8209/EXPLORING THE EFFECT OF SERETOME OF PLALTELET MESENCHYMAL STEM CELL SPHEROIDS ON ANGIOGENESIS AND HEALINGCHRONIC WOUNDS	0.00	2588000.00	0.00	2588000.00	0.00



0.00	0.00	287680.00	340837.00	386012.00	1014529.00	1014529.00	-1475.00
0.00	0.00	284742.00	80132.20	548623.00	913497.20	913497.20	85574.80
0.00	0.00	725193.00	190780.00	100000.00	1015973.00	1015973.00	49627.00
	0.00	159306.00	187975.00	14202407.00	14549688.00	14549688.00	70533513.00
0.00	0.00	238794.00	634255.00	0.00	873049.00	873049.00	597951.00
0.00	0.00	205320.00	15673.00	62000.00	282993.00	282993.00	560007.00
0.00	0.00	194880.00	40540.00	115329.00	350749.00	350749.00	2237251.00



8210	PROJ/8210/DESIGNING AND STUDIES O NANOPLAT-FORMS FOR DIAGNOSTIC IMAGING AND TARGETED THERAPY	0.00	267952.00	0.00	267952.00	0.00
8211	FABRICATION OF TUMOR MICROENVIORNMENT RE-SPONSIVE MoS2/Fe/Au/TA// GoX/FA/ NANOCATALYST FOR SELECTIVE CANCER ABLATIO Via SYNERGISTI C CHEMO DYNAMIC &PHOTO-THERMAL	0.00	1065600.00	0.00	1065600.00	0.00
8212	PROJ/8212/DEVELOPMENT OF WEARABLE ADVANCED FALL DETTECTION WATCH WITH WIRELESS ALARM SYSTEM FOR HELP ACTI-VATION	0.00	724254.00	0.00	724254.00	0.00
8220	PROJ/8220/SPINAL FIXA-TION SYSTEM FOR THORA-COLUMBAR STABLIZATION	3100879.42	0.00	-1954037.42	1146842.00	0.00
8221	PROJ/8221/DEVELOPMENT OF HIGH-STRENGTH TI-6AI-+4V CASTINGS FOR ORTHOPAEDIC IMPLANTS	3472352.57	670000.00	-2619130.57	1523222.00	0.00
8222	PROJ/8222/BIOCERAMIC CAGES WITH AXIALLY ALIGNED PORES AS A SUB-STITUTE FOR TRICORTICAL BONE GRAFT	194402.77	0.00	-194402.77	0.00	0.00
8223	PROJ/8223/CORNEAL EPITHELIAL CELL SHEET ENGINEERING:STANDARD-IZATION & PRE-CLINICAL EVALUATION	2884131.73	0.00	-2299294.73	584837.00	0.00
8232	PROJ/8232/SPINAL CORD STIMULATOR	16528564.00	0.00	-15873776.00	654788.00	16832.00



0.00	0.00	267952.00	0.00	0.00	267952.00	267952.00	0.00
0.00	0.00	127600.00	0.00	100000.00	227600.00	227600.00	838000.00
0.00	0.00	0.00	0.00	50000.00	50000.00	50000.00	674254.00
0.00	0.00	420387.00	726455.00	0.00	1146842.00	1146842.00	0.00
0.00	0.00	424742.00	1098480.00	0.00	1523222.00	1523222.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	402643.00	182194.00	0.00	584837.00	584837.00	0.00
0.00	16832.00	577239.00	60717.00	0.00	637956.00	654788.00	0.00



8233	PROJ/8233/RAPID DIAG- NOSTIC KITS	9740534.40	0.00	-8890350.40	850184.00	0.00
8237	PROJ/8237/Oropharyngeal Sample Collection Kit"	0.00	0.00	48520.00	48520.00	0.00
8239	PROJ/8239/Development of a cost effective Ventilator"	690938.07	0.00	-416451.07	274487.00	0.00
		283808190.18	24391144.00	64849651.10	373048985.28	13783537.00

	INTERNAL PROJECTS					
6230	PROJ/6230/CAVITY CON- FORMABLE SSSR	0.00	0.00	135450	135450.00	0.00
6235	PROJ/6235/PLATELET RICH PLASMA	0.00	0.00	38010	38010.00	0.00
6236	PROJ/6236/VASCULAR MODEL	0.00	0.00	2904	2904.00	0.00
6237	PROJ/6237/SUCTION-RE- TRACTOR DEVICE	0.00	0.00	18000	18000.00	0.00
6238	PROJ/6238/COMPLETE BLOOD COUNT	0.00	0.00	1500	1500.00	0.00
6239	PROJ/6239/ALGINATE DIALDEHYDE	0.00	0.00	72000	72000.00	0.00
6240	PROJ/6240/BONE GRAFT EXPANDER	0.00	0.00	23500	23500.00	0.00
6241	PROJ/6241/PORCINE PERI- CARDIUM	0.00	0.00	198700	198700.00	0.00
6243	PROJ/6243/RS.5.10 LAKHS	0.00	0.00	168876	168876.00	0.00
6244	PROJ/6244/AUGMENTAT. ANALYTICAL FACILITY	0.00	0.00	5381	5381.00	0.00
6245	PROJ/6245/CERAMIC TILE FORMS	0.00	0.00	294827	294827.00	0.00
6247	PROJ/6247/PRE-VALIDA- TION OF IN VITRO ...	0.00	0.00	3780	3780.00	0.00



0.00	0.00	47692.00	802492.00	0.00	850184.00	850184.00	0.00
0.00	0.00	0.00	48520.00	0.00	48520.00	48520.00	0.00
0.00	0.00	0.00	274487.00	0.00	274487.00	274487.00	0.00
0.00	13783537.00	25708536.00	61804767.20	120199214.10	207712517.30	221496054.30	151552930.98

0.00	0.00	0.00	135450.00	0.00	135450.00	135450.00	0.00
0.00	0.00	0.00	38010.00	0.00	38010.00	38010.00	0.00
0.00	0.00	2904.00	0.00	0.00	2904.00	2904.00	0.00
0.00	0.00	18000.00	0.00	0.00	18000.00	18000.00	0.00
0.00	0.00	0.00	1500.00	0.00	1500.00	1500.00	0.00
0.00	0.00	0.00	72000.00	0.00	72000.00	72000.00	0.00
0.00	0.00	0.00	23500.00	0.00	23500.00	23500.00	0.00
0.00	0.00	0.00	198700.00	0.00	198700.00	198700.00	0.00
0.00	0.00	168000.00	876.00	0.00	168876.00	168876.00	0.00
0.00	0.00	0.00	5381.00	0.00	5381.00	5381.00	0.00
0.00	0.00	0.00	294827.00	0.00	294827.00	294827.00	0.00
0.00	0.00	0.00	3780.00	0.00	3780.00	3780.00	0.00



6248	PROJ/6248/development of a device	0.00	0.00	184507	184507.00	0.00	
6250	PROJ/6250/DEVELOPMENT OF A DEVICE.....	0.00	0.00	10983	10983.00	0.00	
		0.00	0.00	1158418.00	1158418.00	0.00	
	Total (C)	283808190	24391144	66008069	374207403	13783537	
	GRAND TOTAL (A+B+C)	863069350	116150940	804836657	1784056947	15603411	



0.00	0.00	0.00	184507.00	0.00	184507.00	184507.00	0.00
0.00	0.00	0.00	10983.00	0.00	10983.00	10983.00	0.00
0.00	0.00	188904.00	969514.00	0.00	1158418.00	1158418.00	0.00
0	13783537	25897440	62774281	120199214	208870935	222654472	151552931
0	15603411	67844152	76045674	868537395	1012427221	1028030632	756026314



**SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES & TECHNOLOGY,
THIRUVANANTHAPURAM**

SCHEDULE 4-SECURED LOANS AND BORROWINGS:		2022-2023	2021-2022
	1. Central Government	--	--
	2. State Government (Specify)	--	--
	3. Financial Institutions	--	--
	a) Term Loans	--	--
	b) Interest accrued and due	--	--
	4. Banks:	--	--
	a) Term Loans-Interest accrued and due	--	--
	b) Other Loans(specify)- Interest accrued and due-Over draft	--	--
	5. Other Institutions and Agencies	--	--
	6. Debentures and Bonds	--	--
	7. Others(Specify)	--	--
	Against OD facility- cheques issued	--	--
	TOTAL		
SCHEDULE 5-UNSECURED LOANS AND BORROWINGS		2022-2023	2021-2022
	1. Central Government	--	--
	2. State Government (Specify)	--	--
	3. Financial Institutions	--	--
	4. Banks:	--	--
	a) Term Loans	--	--
	b) Other Loans(specify)	--	--
	5. Other Institutions and Agencies	--	--
	6. Debentures and Bonds	--	--
	7. Fixed Deposits	--	--
	8. Others(Specify)	--	--
	TOTAL		
SCHEDULE 6-DEFERRED CREDIT LIABILITIES:		2022-2023	2021-2022
	a) Acceptances secured by hypothecation of capital equipment and other assets	--	--
	b) Others		
	TOTAL	--	--

Sd/-
Financial Adviser

Sd/-
Director



**SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES & TECHNOLOGY,
THIRUVANANTHAPURAM**

SCHEDULE 7-CURRENT LIABILITIES AND PROVISIONS		2022-2023	2021-2022
1. Acceptances			
2. Sundry Creditors:			
a) For Goods		213718097	195201488
b) Others		0	0
3. Advances Received		62512902	84190898
4. Interest accrued but not due on:		0	0
a) Secured Loans / borrowings		0	0
b) Unsecured Loans / borrowings		0	0
5. Statutory Liabilities:		0	0
a) Overdue			
b) Others		6300527	6938924
6. Other current Liabilities		187900528	452019441
TOTAL(A)		470432055	738350752
B. PROVISIONS			
1. For Taxation		0	0
2. Gratuity		0	0
3. Accumulated Leave Encashment		0	0
4. Trade Warranties/Claims		0	0
5. Others(Specify) Audit fee		350000	400000
Emergency Reserve Fund contribution		0	0
Technology Development Fund contribution		4011476	3764366
TOTAL(B)		4361476	4164366
TOTAL(A+B)		474793531	742515118

Sd/-
Financial Adviser

Sd/-
Director



SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL

SCHEDULE 8- FIXED ASSETS

PARTICULARS	GROSS BLOCK			
	Cost/valuation as at the beginning of the year (01.04.2022)	Additions during the year 2022-23	Deductions during the year 2022-23	Cost
A. FIXED ASSETS:				
1. LAND:				
a) Freehold	16894606	0	0	
b) Leasehold				
2. BUILDINGS:				
a) On Freehold Land *	47627608	0	0	
b) On Leasehold Land				
c) Ownership Flats/Premises				
d) Superstructures on Land not belonging to the entity	477182357	0		
3. A) PLANT MACHINERY & EQUIPMENT	3255439286	31564583	10120488	
B) Equipment - From Non Monetary grants	2	0	0	
4. VEHICLES	8546800	0		
5. FURNITURE, FIXTURES	94116190	442471	0	
6. OFFICE EQUIPMENT	1236622	0	0	
7. COMPUTER/ PERIPHERALS	9108546	0	1930876	
8. ELECTRIC INSTALLATIONS	173068457	0	0	
9. LIBRARY BOOKS	247104725	13351264	0	
10. TUBEWELLS & W.SUPPLY	301965	0		
11. OTHER FIXED ASSETS				
A) OXYGEN CYLNDRS/GAS PLANT INST	3011724	10871680		
B) KITCHEN/CANTEEN EQUIPMENTS	4111782	187317	0	
C) PAINTINGS	450216	0		
D) SURGICAL EQUIPMENTS	1147384	0	0	
Total for the year (Total -A)	4339348268	56417315	12051364	
Total for the previous year	4285709814	577747478.8	110010482.4	
Capitall Work in Progress (B)	1051641071	554155423	0	
Total for the year (A+B)	5390989339	610572738	12051364	

* Depreciation for item2(a) has been provided along with depreciation on 2(d)

Sd/-
Financial Adviser

Sd/-
Director



SCIENCES & TECHNOLOGY, THIRUVANANTHAPURAM

Valuation at the year end (31.03.2023)	DEPRECIATION				NET BLOCK	
	Depreciation as at the beginning of the year (01.04.2022)	Depr on items written off	During the year 2022-23	Total up to the year end (31.03.2023)	As at the end of current year end (31.03.2023)	As at the previous year end (31.03.2022)
16894606	0	0	0	0	16894606	16894606
47627608	0		0	0		
477182357	371606985	0	15320298	386927283	137882681	153202979
3276883381	2445543117	8591856	125989818	2562941080	713942301	809896169
2	1	0	0	1	1	1
8546800	7676613		130528	7807141	739659	870187
94558661	60269777	0	3428888	63698666	30859995	33846413
1236622	1111206		12542	1123747	112875	125416
7177670	8931180	1930866	70942	7071256	106414	177366
173068457	123589256	0	4947920	128537177	44531281	49479201
260455989	228974634	0	12592542	241567176	18888813	18130091
301965	247286		5468	252754	49211	54679
13883404	2384642		4599505	6984147	6899257	627082
4299099	2187775	0	211132	2398908	1900192	1924007
450216	419319		3090	422409	27807	30896
1147384	1129421	0	7185	1136606	10778	17963
4383714219	3254071213	10522722	167319858	3410868350	972845869	1085277056
5390989339	3171993332	100151715	80896021	3252889354	2138099986	2136918125
1605796494	0	0	0	0	1605796494	1051641071
5989510713	3254071213	10522722	167319858	3410868350	2578642363	2136918125

Sd/-
Financial Adviser

Sd/-
Director



**SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES & TECHNOLOGY,
THIRUVANANTHAPURAM**

SCHEDULE 9 - INVESTMENTS FROM EARMARKED/ENDOWMENT FUNDS		2022-2023	2021-2022
1. In Government Securities		47081032	47081032
2. Other approved Securities		5685391	5685391
3. Shares		0	0
4. Debentures and Bonds		0	0
5. Subsidiaries and Joint Ventures		0	0
6. Others (to be specified)		0	0
	Pension & staff funds	165563328	159720544
	Project funds	166813610	269829648
TOTAL		385143361	482316615
SCHEDULE 10-INVESTMENTS-OTHERS		2022-2023	2021-2022
1. In Government Securities		--	--
2. Other approved Securities		--	--
3. Shares		--	--
4. Debentures and Bonds		--	--
5. Subsidiaries and Joint Ventures		--	--
6. Others (to be specified) Sinking Fund Investments		150000000	150000000
	Technology Fund	105904290	102139924
6. Others (to be specified)		--	--
TOTAL		255904290	252139924
SCHEDULE 11-CURRENT ASSETS,LOANS,ADVANCES ETC		2022-2023	2021-2022
A. CURRENT ASSETS			
1. Inventories:			
	a) Stores and Spares	0	0
	b) Instruments & Loose Tools	0	0
	c) Stock-in trade		
	Store items	140802730	122651633
		0	0
	Stamps	4838	5519
	Medicine	37218338	15714258
2. Sundry Debtors:		0	0
	a) Debts Outstanding for a period exceeding six months	204197393	30262021
	b) Others	305881210	254242084
	2.1 Income tax deducted at source	6011157	3634222



3. Cash balances in hand(including cheques/ drafts and imprest)	1561407	3002296
4. Bank Balances:	0	0
a) With Scheduled Banks:	0	0
-On Current Account	2227630	2227630
-On Deposit Accounts(L.C. margin & Commitment deposit)	3296643423	3236795718
-On Savings Accounts	319990284	422041427
b) With non-Scheduled Banks:	0	0
-On Current Account	0	0
-On Deposit Accounts	0	0
-On Savings Accounts	0	0
5. Post-Office-Savings Accounts	0	0
TOTAL(A)	4314538410	4090576808
B.LOANS, ADVANCES AND OTHER ASSETS		
1. Loans:		
a) Staff	13854628	14256281
b) Other Entities engaged in activities/ objectives similar to that of the Entity	0	0
c) Other(specify)	0	0
2. Advances and other amounts recoverable in cash or in kind or for value to be received:	0	0
a) On Capital Account	102500678	348682198
b) Prepayments	0	0
c) Others	19117841	12785128
3. Income Accrued:	0	0
a) On Investments from Earmarked/ endowment Funds	36002268	15429623
b) On Investments-Others	0	0
c) On Loans and Advances	0	0
d) Others (Royalty)	1097452	1614087
(includes income due unrealised)	0	0
4. Claims Receivable	0	0
From Govt of India on Grant in aid (7th CPC arrears)	204714247	204714247
TOTAL(B)	377287114	597481564
TOTAL(A+B)	4691825524	4688058372
Savings bank account includes Rs.15/- (GL code No.2410-Synd Bank vikas certificate)		



SCHEDULE 12- INCOME FROM SALES/SERVICES		2022-2023	2021-2022
1. Income from Sales			
	a) Sale of Finished Goods	0	0
	b) Sale of Raw Material	0	0
	c) Sale of Scraps	0	0
2. Income from Services			
	a) Labour and processing charges	0	0
	b) Professional/Consultancy Services	0	0
	c) Agency Commission and Brokerage	0	0
	d) Maintenance Services	0	0
	e) Others (Specify)	0	0
	From Hospital Services-Gross Income	1148889561	992774803
		0	0
	From Projects	4114199	3959513
	Testing & Facility charges received	5153367	3620948
	TOTAL	1158157127	1000355264
SCHEDULE 13- GRANTS/SUBSIDIES		2022-2023	2021-2022
	(Irrevocable Grants & Subsidies Received)		
1. Central Government (Salary & General)		2584837737	3100100000
2. State Government(s)		0	0
3. Government Agencies		0	0
4. Institution/Welfare Bodies		0	0
5. International Organisations		0	0
6. Others(Specify)		0	0
	TOTAL	2584837737	3100100000
SCHEDULE 14-FEES/SUBSCRIPTIONS		2022-2023	2021-2022
1. Entrance Fees		883630	1005560
2. Annual Fees/ Subscriptions		12091985	12423119
3. Seminar/Program Fees		0	0
4. Consultancy Fees		0	0
5. Examination Fees and others		4082325	2295810
	TOTAL	17057940	15724489
SCHEDULE 15- INCOME FROM INVESTMENTS		2022-2023	2021-2022
1) Interest			
	a) On Govt. Securities	0	0
	b) Other Bonds/Debentures	0	0



	2) Dividends:		
	a) On Shares	0	0
	b) On Mutual Fund Securities	0	0
	3) Rents	0	0
	4) Others(Special Reserve Funds)1. Interest on Sinking Fund	7023357	14350069
	2. Withdrawal from Sinking Fund	0	0
	3. Interest on Technology Fund	11766476	236869
	TOTAL	18789833	14586937
SCHEDULE 16- INCOME FROM ROYALTY,PUBLICATION ETC		2022-2023	2021-2022
	1) Income from Royalty	2671343	4981543
	2) Income from Publications	0	0
	3)Others(Specify)	0	0
	TOTAL	2671343	4981543
SCHEDULE 17- INTEREST EARNED		2022-2023	2021-2022
	1) On Term Deposit		
	a) With Scheduled Banks	104219455	20651939
	b) With non-scheduled banks	0	0
	c) With Institutions	0	0
	d) Others	0	0
	2) On Savings Account	0	0
	a) With Scheduled Banks	8513829	10054301
	b) With non-scheduled banks	0	0
	c) Post Office Savings Account	0	0
	d) Others(accrued)	0	0
	3) On Loans	0	0
	a) Employees/Staff	876382	505179
	b) Others	0	0
	4) Interest on Debtors and other Receivables	0	0
	TOTAL	113609666	31211419
SCHEDULE 18- OTHER INCOME		2022-2023	2021-2022
	1. Profit on Sale/disposal of Assets:		
	a) Owned assets	0	0
	b) Assets acquired out of grants, or received free of cost	0	0
	c) WIP written back from Repairs and Maintenance	0	0



2. Rent	2936641	2198135
3. Fees for Miscellaneous Services	0	0
4. Miscellaneous Income	7503848	328281
Rent		
Other Income (including grant receivable from DST for 7th CPC)	10738723	19056315
Prior period income	0	7689847
TOTAL	21179212	29272578
SCHEDULE 20-ESTABLISHMENT EXPENSES	2022-2023	2021-2022
a) Salaries and Wages	1401921908	1359170744
b) Allowances and Bonus	20306952	19974402
c) Contribution to Provident Fund	0	0
d) Contribution to other fund(specify)	0	0
e) Staff Welfare Expenses	14135784	14243025
f) Expenses on Employee's Retirement and Terminal Benefits	481037786	525694728
g) Others(Specify) PG Training & Accademic payments	192857147	187217456
TOTAL	2110259577	2106300355
SCHEDULES 21- ADMINISTRATIVE EXPENSES	2022-2023	2021-2022
a) Purchases	670038272	744098540
b) Concession to Poor patients/Labour and processing expenses	62512674	79945413
c) Cartage and Carriage Inwards	108117	358601
d) Electricity and power	58790792	56932664
e) Water charges	5374858	6039172
f) Insurance	3650911	5031522
g) Repairs and maintenance	35501987	30450588
h) Excise duty	0	0
i) Rent,Rates and Taxes	581405	0
j) Vehicles Running and Maintenance	1062254	643296
k) Postage,Telephone and Communication Charges	3180150	4789743
l) Printing and Stationary	31681	20453
m) Travelling and Conveyence Expenses	4500001	642829
n) Expenses on Seminar/Workshop	493533	183673
o) Subscription Expenses	0	0
p) Expenses on Fees	0	0
q) Auditors Renumeration	2184260	784069
r) Hospitality Expenses	0	0
s) Professional Charges	0	0
t) Provision for Bad and Doubtful Debts/Advances	0	0
u) Irrecoverable Balances Written-off	0	0
v) Packing Charges	0	0



	w) Freight and Forwarding Expenses	0	0
	x) Prior period expenses	55227545	46761773
	y) Distribution Expenses	0	0
	z) Advertisement and Publicity	1314302	2969159
	z1) Others(specify)	46511927	36832847
	TOTAL	951064669	1016484341
SCHEDULE 23-INTEREST		2022-2023	2021-2022
	a) On Fixed Loans		
	b) Bank Charges)	371592	1915089
	c) Others(specify)	0	0
	TOTAL	371592	1915089

Sd/-
Financial Adviser

Sd/-
Director



**SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES & TECHNOLOGY,
THIRUVANANTHAPURAM
SCHEDULES FORMING PART OF ACCOUNTS AS AT 31-03-2023**

SCHEDULE 24- SIGNIFICANT ACCOUNTING POLICIES

ACCOUNTING CONVENTION

Financial Statements are prepared based on historical cost convention and accrual method of accounting except in the accounts not directly connected with the functioning of the Institute including the Staff Benevolent Fund, Pension, etc.

2. INVENTORY VALUATION

Stores and spares including machinery spares are valued at cost.

3. INVESTMENTS

Investments including long-term investments are carried at cost.

4. FIXED ASSETS

Fixed assets are stated at the cost of acquisition inclusive of inward freight, duties and taxes incidental and direct expenses related to the acquisition. Non-monetary assets acquired free of cost are recorded at a nominal value ie. Re.1 (Rupee One).

5. DEPRECIATION

Depreciation is provided on the reducing balance method at the rates specified by the Income Tax Act 1961. In respect of additions to fixed assets during the year depreciation is provided for the full year. In case of condemnation of an asset, depreciation for the current year has not been provided and the accumulated depreciation for the previous years has been duly deducted from the accumulated depreciation and is shown in Schedule 1 - as was suggested by the audit party during the previous year audit (2021-22)

6. GOVERNMENT GRANTS/SUBSIDIES

Government Grant from Plan fund-Capital is treated as additions to the Capital fund of the of Institute. Grants in respect of specific fixed assets acquired are shown as a deduction from the cost of the related asset. Government Grants/subsidies are accounted on a Grant release order basis, except grant-in-aid receivable for meeting arrears on account of the 7th CPC.

7. FOREIGN CURRENCY TRANSACTIONS

Transactions denominated in foreign currency are accounted at the exchange rate prevailing at the date of transactions.

8. RETIREMENT BENEFITS

Gratuity: From 2006 (with the implementation 6th Pay Commission report), the gratuity payments are treated as Institute expenses and accounted for on an actual payment basis.

Leave Salary: Leave encashment eligible at the time of retirement/reliving is treated as Institute expenses and accounted for on an actual payment basis.

Pension: From the year 2006, (with the implementation 6th Pay Commission report) 12% of the salary is transferred to the Pension Fund.

New Pension Scheme: In the case of employees who joined on or after 01.01.2004, 10% of the salary is deducted as an employee's subscription and an equal contribution is being made by the Institute. The funds are remitted to NPS Trust Account maintained by GOI and subscription details are forwarded to NSDL/CRA every month.

9. PROVIDENT FUND

Assets and Liabilities of the General Provident Fund account were separated from the Balance sheet of the Institute and shown as separate statements. Interest is provided on the accumulations as per the rates prescribed by Central Government from time to time.

10. EMERGENCY RESERVE FUND

An amount equal to 7.50 per cent of receipts from patients is to be transferred to a Fund for meeting unexpected requirements for Fixed assets subject to a maximum of Rs.50 Crore. It was decided to reduce the limit of ERF to Rs.15 crore and utilize the remaining funds and the guideline of recouping these funds does not apply until further decision.

11. TECHNOLOGY DEVELOPMENT FUND

Receipts against technology developed by the Institute are transferred to the above fund and interest earned is utilized for meeting additional expenses on Improvement of technologies already developed.

Sd/-
Financial Adviser

Sd/-
Director



SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES & TECHNOLOGY, THIRUVANANTHAPURAM

SCHEDULE 25-CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS

1. CONTINGENT LIABILITIES

	Rs. In lakhs	
	2022-23	2021-22
Claims against the Institute not acknowledged as debts	NIL	NIL
Bank Guarantee given by Institute	52.81	45.96
Letters of credit opened on behalf of Institute	85.66	19.81
In respect of claims from parties for non- execution of orders	NIL	NIL

Service Tax :

“ The office of the Commissioner of Central Excise and Customs vide order no: C.No.IV/16/152/2014 ST ADJ. Dated 08.06.2015 confirm the demand of Service tax Rs.4.72 Lakhs under section 73(2) of the Finance Act 1994, being service tax short paid under the category “Technical Inspection and certification service” during the period 1.4.2009-31.03. 012. Further, impose a penalty of Rs 2.36 lakhs towards penalty under section 78 and Rs.0.05 lakhs for contravention of section 70 of the Act. To file an appeal against the order, the institute paid Rs.0.35 lakhs towards a deposit (i e 7.5% of demand confirmed).” During the year 2018-19, Institute received Order-In-Appeal dated 19.09.2018 issued by Commissioner (Appeals) rejecting the appeal filed by the Institute. Institute filed an appeal before CESTAT, Bangalore against the above and remitted Rs.0.44 lakh as a deposit under section 35F of the CE Act.

Name of the Statute	Nature of Dues	Amount in Rs. in lakhs	Period to which the amount relates	Forum where dispute is pending.
Service Tax	Service tax and penalty	4.72	01/04/2009 to 31/03/2012	CESTAT, Bangalore.

2. UNEXPIRED CAPITAL COMMITMENTS

	Rs. in lakh	
	2022-23	2021-22
The Estimated value of orders remaining to be executed on Capital Account	1084.99	8006.11
Construction of New Hospital block (NHB)& Hospital Equipments & Facilities for NHB	4004.99	6309.85
Completion of Combination Devices Block	121.19	2291.18

Ministry of Health and Family Welfare approved the construction of a new Hospital Block in the Institute at a cost of Rs.230 crore. The project is funded jointly by the Ministry of Health and Family Welfare - MoHFW (Rs. 120 crore) and the Department of Science & Technology - DST (Rs. 110 crore). Institute received Rs. 110 crore from DST; out of which Rs. 90 crore was paid as advance to CPWD. CPWD received another Rs. 31 crore directly from MoHFW.

Administrative approval and expenditure sanction was accorded for the completion of Combinational Devices Block (Originally called Biology Block) at the BMT wing vide BMT letter dated 21.05.2018. The work is executed through CPWD and was completed and inaugurated on 15.11.2022. Animal House and CDB will be capitalized on receipt of Completion certificate.

Lease obligation for rentals for Plant & Machinery	NIL	NIL
--	-----	-----

3. CURRENT ASSETS, LOANS & ADVANCES

The aggregate amount shown in the Balance sheet for the Current assets, Loans and Advances, has the value, which is realisable in the ordinary course of business.

4. PROVISIONS

Provision for Income tax was not made since there is no taxable income for Institute under Income tax Act 1961, during the year.



5. FOREIGN CURRENCY TRANSACTIONS:

Rs. in lakh

	2022-23	2021-22
5.1 Value of Imports		
Capital Goods	36.65	368.51
Stores Spare & Consumables	16.85	15.27
5.2 Expenditure in foreign currency		
Travel Expenses	NIL	NIL
5.3 Earnings:		
Value of Exports	NIL	NIL

- 6 Current year Income, net of expenditure, under the Institute Ethics Committee has been treated as income of the Institute amounting to Rs.24.75 lakh (previous year Rs.24.47 lakh).
7. Claim for Audit fees by C&AG amounting to Rs.0.98 lakh has been paid during the year. Provision for Audit fees of C&AG and others has been made for the current year amounting to Rs.8.50 lakh.
8. Accrued Interest on Investment amounting to Rs.360.02 lakh (previous year Rs.154.30 lakh) has been provided in the current year accounts.
9. As pointed out by C&AG, an unutilized portion of Grant in Aid(ST General) is shown as current liability.
10. To release the pension dues as per the CCS pension rules, an additional amount of Rs.3221.54 lakh has been expended over and above the sanctioned 12% Institute contribution (amounting to Rs.315.92 lakh) to the Pension Fund.
11. Institute has done the actuarial valuation to ascertain the liability on account of Gratuity, Pension and Leave Encashment in respect of serving employees through an Actuary. As per their valuation report, the liability is as follows :

Present value of the past service gratuity (CCS)	Rs. 1966.72 lakh
Present value of the past service gratuity (NPS)	Rs. 2829.27 lakh
Present value of the pensionary liability for serving employees	Rs. 23278.00 lakh

Sd/-
Financial Adviser

Present value of the pensionary liability for Existing pensioners	Rs. 40000.00 lakh
Present value of the past service leave encashment	Rs. 3835.30 lakh

12. (a) Value of assets acquired from externally funded projects during the last three years has been identified as detailed below:-

FY 2020-21	Rs. 518.19 lakh
FY 2021-22	Rs. 1043.04 lakh
FY 2022-23	Rs. 156.03 lakh

Since the cost of acquisition of these assets is nil, no depreciation has been charged on these assets.

(b) Value of non-monetary assets acquired by the Institute is shown at a nominal value of Rs.2.

13. Technology Development Fund

An amount of Rs. 37.64 lakh (previous year Rs. 73.10 lakh) was transferred to Technology Development Fund. During the year Rs.13.37 lakh has been spent from Technology Development Fund. (Previous year Rs.42.38 lakh)

14. Funding of In house Projects to set off negative balance.

Administrative expenses include an amount of Rs.7.77 lakh (Previous year Rs.14.90 lakh) transferred to In house project fund to set off negative balance.

15. Grant release order received for Capital Rs.3000.00 lakh, for General Rs. 19000.00 lakhs, and General Rs. 11500.00 lakhs for expenditure through TSA. Expenditure from Capital head Rs. 408.36 lakhs; Salary head Rs.15005.52 lakh; General head Rs. 10842.86 lakh. (Thereby leaving the unspent/lapsed GOI from TSA amount to Rs. 2591.64 under Capital, Rs. 3994.48 lacks under Salary and Rs. 657.14 lakh under General. (Though expenditures of Rs. 51.07 lakh under capital, Rs. 2000 lakh under Salary and Rs. 656.99 lakh under General were booked, the debit was not successful due to a Glitch in the RBI server)

An amount of Rs.251.38 lakh is being repaid as interest on an unutilized non-TSA grant (PMSSY & ST grant) to DST and Rs.123.94 lakh is repaid as interest to MoHFW as interest on the unutilized grant (PMSSY)

16. Corresponding figures for previous years have been regrouped, wherever necessary.

Schedules 1 to 25 annexed, form an integral part of the Balance Sheet as of 31-03-2023, and Income & Expenditure Account for the year ended on that date.

Sd/-
Director



**SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES & TECHNOLOGY,
THIRUVANANTHAPURAM**

SCHEDULE TO RECEIPTS & PAYMENTS ACCOUNTS FOR THE PERIOD FROM 01-04-2022 TO 31-03-2023

RECEIPTS		2022-23	2021-22	Payments		2022-23	2021-22
		Rs.	Rs.			Rs.	Rs.
I	Opening Balances			I	Expenses		
a)	Cash In Hand	3002296	1738986				
b)	Bank Balances			a)	Establishment expenses	2309960758	2660647855
	i) In Current Account	1	1	b)	Administrative Expenses		
	ii) In deposit Account				For Purchases	17201799	14797955
	iii) Savings Account *	424269070	1276174806		Other expenses	79997227	75096108
				II	Payments made against funds for various Projects		
II	Grant Received						
	From Government of India				As Per schedule	179273478	178217550
	Under Object head - Creation of Capital assets	40835703	250000000				
	Under Object Head - Salary/General scheme	2584837737	3100100000	III	Investments & Deposits made		
					a) Out of Earmarked funds	114711101	115047883
					b) Out of own funds		
III	Receipts against Earmarked Funds						
				IV	Expenditure on Fixed Assets & Capital work		
	a) Earmarked funds	164644743	297949560		-in- progress		
	b) Own funds						
					a) Purchase of Fixed Assets	48037881	21705406
IV	Interest Received				b) Capital work-in-progress		
	a) On Bank deposits	50713591	31729132	V	Refund of Loans		



**SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES & TECHNOLOGY,
THIRUVANANTHAPURAM
Provident Fund Account For The Year Ended 31-03-2023**

Particulars	2022-23 [Rupees]	2021-22 [Rupees]
LIABILITIES		
MEMBERS BALANCE	64663533	75921148
MEMBERS CREDITS [for march]	2429890	3359183
BALANCE DUE TO MEMBERS NOT IN SERVICE		
Under EPF scheme	7696198	7696198
GPF	532055	532055
PENSION FUND DUES	0	0
RESERVES&SURPLUS-INTEREST	268764192	250783722
TOTAL	344085868	338292306
ASSETS		
INVESTMENT AT COST	328902408	321105898
DUES TO PF ACCOUNT		
FROM INSTITUTE	2429890	3359183
FROM PF COMMISSIONER	0	0
INTEREST ACCRUED NOT DUE	10934987	6830344
BALANCE WITH BANKS		
SBT -GPF A/C	1818583	6996882
TOTAL	344085868	338292306

Sd/-
Financial Adviser

Sd/-
Director



Separate Audit Report of the Controller & Auditor General of India on the Accounts of Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Thiruvananthapuram for the year ended 31 March 2023.

1. We have audited the Balance Sheet of Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Thiruvananthapuram as of 31 March 2023, the Income & Expenditure Account and the Receipts & Payment Account for the year ended on that date under Section 19 (2) of the Comptroller & Auditor General's (Duties, Powers & Conditions of Service) Act, 1971 read with section 18 (2) of the SCTIMST Act, 1980. These financial statements include the accounts of Bio-Medical Technology (BMT) wing of the SCTIMST. These financial statements are the responsibility of the SCTIMST's management. Our responsibility is to express an opinion on these financial statements based on our audit.
2. This Separate Audit Report contains the comments of this office on accounting treatment only with regard to classification, conformity with the best accounting practices, accounting standards and disclosure norms etc. Audit observations on financial transactions with regard to compliance with the Law, Rules & Regulations (Propriety and Regularity) and efficiency-cum-performance aspects etc. if any, are reported through Inspection Reports/ CAG's Audit Reports separately.
3. We have conducted our audit in accordance with auditing standards generally accepted in India. These standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatements. An audit includes examining, on a test basis, evidence supporting the amounts and disclosure in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of financial statements. We believe that our audit provides a reasonable basis for our opinion.
4. Based on our audit, we report that:
 - i. We have obtained all the information and explanations which to the best of our knowledge and belief were necessary for the purpose of our audit.
 - ii. The Balance Sheet, Income & Expenditure Account and Receipt & Payment Account dealt with by this report have been drawn up in the format approved by the Government of India, Ministry of Finance.
 - iii. In our opinion, proper books of accounts and other relevant records have been maintained by the SCTIMST as required under Section 18 (1) of SCTIMST Act, 1980 in so far as it appears from our examination of such books subject to observations made hereunder.
 - iv. Based on our audit, we further report that:
 - (A) **Balance Sheet**
 - A.1. **Fixed Assets (Schedule-8) of Rs. 257.86 Crore**
 - (i) Assets procured out of sponsored agencies not reported in Accounts (AO-4)

As per Rule 233(ii) of GFR 2017, on completion of the projects or schemes, if the assets are allowed to be retained by the sponsoring institute/



organization, the implementing agency should include the assets at book value in their own accounts. As per Paragraph 12 of Schedule-25 for the year ended March 2023, the value of assets acquired from on-going external projects for the last three years were reported. The value of Assets from April 2014 to March 2023 was Rs. 55.24 crore. At the instance of Audit, SCTIMST decided (July 2023) to include assets worth Rs. 38.07 crore pertain to the six-year period from 2014-20 to its fixed assets. However, the revision in accounts is pending.

(B) Income and Expenditure Account

Other Income Rs. 2.12 crore (Schedule-18)-AO 9

The proceeds from the external projects towards general revenue expenses shall be credited to the Income (Schedule-18: Other Income) of the institute since general revenue expenses are met from the expenses account (Schedule-21: Administrative Expenses).

The cost of 'Animal Research Expenses' from the external projects amounting to Rs. 0.48 Crore (Balances at the end of March 2023) however were not credited to the Other Income (Schedule-18), although, the general animal research expenses were met from 'Other Administrative Expenses' (GL Code 3170). Instead, the proceeds from the external projects towards Animal Feed were credited under a separate account 'Cost of Animal Feed' (GL Code 7220) created for the purpose under 'Earmarked/ Endowment Fund' of Schedule-3.

Thus, other Income (Schedule 18) account was understated and 'Earmarked/ Endowment Fund of Schedule 3 overstated by Rs. 0.48 crore.

(C) General

C.1. Current Liabilities and Provisions (Schedule-7) of Rs. 47.48 crore

As per Paragraph 8 of Schedule-24 Significant Accounting Policies of the Annual Accounts for the year 2022-23, the retirement benefits are being accounted for on actual payment basis by SCTIMST. The above do not include liability of Rs. 683.73 crore on account of Pension, Gratuity and Accumulated Leave Encashment. Therefore, the same needs to be disclosed in Notes on Accounts.

C.2. Grant-in-aid (AO 2)

Treasury Single Account System (TSA) is an assignment bank account opened by the PAO with Reserve Bank of India. The system is evolved to bring Autonomous Bodies to receive Grants-in-Aid and incur expenditure there against. Out of the Grants-in-Aid of Rs.335 crore received during the year, the SCTIMST could utilize a sum of Rs.262.57 crore leaving a balance of Rs.72.43 crore as unutilized grant as on 31st March 2023 which was lapsed.

(D) Management letter

Deficiencies which have not been included in the Draft Separate Audit Report were brought to the notice of Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thiruvananthapuram through a Draft Management letter issued separately for remedial/ corrective action.

- i) Subject to our observations in the preceding paragraphs, we report that the Balance Sheet, Income & Expenditure Account and Receipts & Payment Account dealt with in this report are in agreement with the books of accounts.



ii) In our opinion and to the best of our information and according to the explanations given to us, the said financial statements read together with the Accounting Policies and Notes on Accounts, subject to the significant matters stated above and other matters mentioned in Annexure to this Audit Report give a true and fair view in conformity with accounting principles generally accepted in India.

a. In so far as it relates to the Balance Sheet of

the state of affairs of the Sree Chitra Tirunal Institute for Medical Sciences & Technology, Thiruvananthapuram as of 31 March 2023; and

b. In so far as it relates to the Income & Expenditure Account of the surplus for the year ended on that date.

For and on behalf of C&AG of India

Sd/-

Director General of Audit, Environment
and Scientific Departments, New Delhi

Date: 25-10-2023
Place: New Delhi



Reply to Separate Audit Report of the Comptroller & Auditor General of India on the Accounts of Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Thiruvananthapuram for the year ended 31 March 2023.

Audit Para No	Observation	Reply of the Institute
<p>A Balance Sheet</p> <p>A1. Fixed Assets (Schedule-8) of Rs 257.86 Crore</p> <p>(i) Assets procured out of sponsored agencies not reported in Accounts (AO-4)</p>	<p>As per Rule 233(ii) of GFR 2017, on completion of the projects or schemes, if the assets are allowed to be retained by the sponsoring institute/organization, the implementing agency should include the assets at book value in their own accounts. As per Paragraph 12 of Schedule-25 for the year ended March 2023, the value of assets acquired from on-going external projects for the last three years were reported. The value of Assets from April 2014 to March 2023 was Rs 55.24 crore. At the instance of Audit, SCTIMST decided (July 2023) to include assets worth Rs 38.07 crore pertain to the six-year period from 2014-20 to its fixed assets. However, the revision in accounts is pending.</p>	<p>Based on the audit observation during the previous certification audit (FY 2021-22), Institute had taken steps to obtain consent from the funding agencies of the projects that are completed, to retain the assets as the stock of the Institute and show it in the fixed assets. This would reveal the book value of these assets in the annual financial statements.</p> <p>As per the Institute's circular dated 30.08.2022, most of the Principal Investigators of completed projects have written to the respective funding agencies such as ICMR, DBT, DST etc. to obtain the consent for retention of assets procured by utilizing the grant in aid allotted. Institute has not received any reply from any of the funding agencies.</p> <p>To comply with the Audit observation, assets acquired out of completed project grants up to the financial year 2019-20 (for 6 years from 2014-15) amounting to Rs. 38.07 crores would be included in the Schedule of fixed assets at the book value of the financial statements during the financial year 2023-24 irrespective of any reply from funding agencies.</p>

<p>(B) Income and Expenditure Account</p> <p>Other Income Rs 2.12 crore (Schedule-18)- AO 9</p>	<p>The proceeds from the external projects towards general revenue expenses shall be credited to the Income (Schedule-18: Other Income) of the institute since general revenue expenses are met from the expenses account (Schedule-21: Administrative Expenses).</p> <p>The cost of 'Animal Research Expenses' from the external projects amounting to Rs 0.48 Crore (Balances at the end of March 2023) however were not credited to the Other Income (Schedule-18), although, the general animal research expenses were met from 'Other Administrative Expenses' (GL Code 3170). Instead, the proceeds from the external projects towards Animal Feed were credited under a separate account 'Cost of Animal Feed' (GL Code 7220) created for the purpose under 'Earmarked/ Endowment Fund' of Schedule-3.</p> <p>Thus, other Income (Schedule 18) account was understated and 'Earmarked/ Endowment Fund of Schedule 3 overstated by Rs 0.48 crore.</p>	<p>The audit may kindly note that at the Biomedical Technology Wing of the Institute, funds are being received for animal study from various external agencies by transferring funds from ongoing projects as part of the study. These funds are pooled and kept in GL Code 7220 and disclosed under Schedule-3, Earmarked/Endowment Fund. Expenses for animal studies are being utilised from such transferred amount and is an ongoing activity which is followed for the past several years. Being an ongoing project, the entire amount available in the project cannot be treated as income. However, as pointed out by the audit, the surplus amount if any after the completion of the study as confirmed by the project investigator will be transferred to Institute as its income.</p>
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<p>(C) General</p> <p>C.1. Current Liabilities and Provisions (Schedule-7) of Rs 47.48 crore</p>	<p>As per Paragraph 8 of Schedule-24 Significant Accounting Policies of the Annual Accounts for the year 2022-23, the retirement benefits are being accounted for on actual payment basis by SCTIMST. The above do not include liability² of Rs 683.73 crore on account of Pension, Gratuity and Accumulated Leave Encashment. Therefore, the same needs to be disclosed in Notes on Accounts.</p>	<p>The liability in respect of Gratuity, Pension and Leave Encashment is disclosed in para 11 of Schedule No. 25 under notes on accounts. The audit may kindly note that during the previous year, a detailed fund requirement for the proposal based on the actuarial valuation and report submitted by the LIC of India for the creation of a Pension fund was forwarded to DST, the administrative Ministry for allotment of funds. It is understood that DST has taken up the matter with DoE for approval & budget allocation. Until a fund that involves huge capital investment is created, the present practice of mentioning the current liability in notes on accounts is made as done in the past several years. Audit may please note that the Institute received a letter from the DST mentioning that it would take care of 100% of the Pensionary benefits to Non-Academic staff and 70% of the Academic staff of the Institute. Copy of the letter already submitted to audit.</p>
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<p>C.2. Grant-in-aid (AO 2)</p>	<p>Treasury Single Account System (TSA) is an assignment bank account opened by the PAO with Reserve Bank of India. The system is evolved to bring Autonomous Bodies to receive Grants-in-Aid and incur expenditure there against. Out of the Grants-in-Aid of Rs.335 crore received during the year, the SCTIMST could utilize a sum of Rs.262.57 crore leaving a balance of Rs.72.43 crore as unutilized grant as on 31st March 2023 which was lapsed.</p>	<p>During the year 2022-23, the utilization of the Grant-in-Aid was done through PFMS and the actual expenditure was booked accordingly. During the financial year, most of the procurement was done through the GeM. Sophisticated hospital equipment was not available in the Gem. Institute is exploring the possibility of including these items by contacting the GeM authorities. On 3rd April 2023, the Department of Expenditure, Ministry of Finance, issued orders regarding the procurement of certain equipment through the Global Tender Enquiry. Thus, the capital grant could not be utilized as was envisaged. These facts were brought to the notice of the DST and the funds were re-allotted to the financial year 2023-24 for effective utilization.</p> <p>Regarding revenue grants for Salary and General, funds were allotted on the late evening of 31st March 2023 and expenditure was booked thereafter. Underutilization was due to a software glitch that occurred in the RBI software/server. These facts were duly disclosed in the notes forming part of the accounts</p>
<p>(D) Management Letter</p>	<p>Deficiencies which have not been included in the Draft Separate Audit Report were brought to the notice of Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thiruvananthapuram through a Draft Management letter issued separately for remedial/ corrective action.</p>	<p>The observations mentioned in the Management letter have been noted for future guidance as well as for remedial/ corrective action.</p>



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