



MANIPAL
ACADEMY of HIGHER EDUCATION
(Institution of Eminence Deemed to be University)

PHYSICAL FACILITIES FOR INTERDISCIPLINARY RESEARCH - MAHE



Manipal Academy of Higher Education (MAHE) prides itself on fostering interdisciplinary research endeavours, providing cutting-edge facilities and collaborative spaces for researchers across various scientific disciplines. Here are some of the facilities specifically geared towards interdisciplinary research teams. MAHE has taken meticulous and meaningful steps to build reservoirs of intellectual wealth and academic excellence. In the process, Manipal Academy of Higher Education has created some of the country's best institutes/schools across several diverse streams like medicine, dentistry, nursing, engineering, pharmacy, hotel management, allied health, architecture and design, communication etc. Each institution/school at Manipal is geared to meet the same demanding standards to create great professionals and citizens by inspiring them in many ways.

Research has always been an area of paramount importance to Manipal Academy of Higher Education. The importance increased tremendously after obtaining the deemed university status. There has been a dramatic rise in the publications, doctoral degree awards and grants awarded by funding agencies since then.

Objectives:

To enhance research collaboration and interdisciplinary networking with national and international partners.

To prioritize research themes based on scientific impact and societal challenges.

To enhance the research outcomes in terms of quality publications, IPR and grants.

Link to find MAHE Research facilities:



<https://researcher.manipal.edu/en/equipments/>

Central Analytical Instrumentation Facility (CAIF): CAIF is designed to be a cutting-edge research center, fully funded by MAHE, equipped to support a wide range of analytical research needs in both basic and applied sciences. The facility hosts an impressive collection of advanced instruments, covering areas such as spectroscopy, thermal analysis, chromatography, mechanical testing, and imaging. The state-of-the-art equipment and comprehensive resources at CAIF are available to researchers from both academic and industrial backgrounds, ensuring MAHE's continued commitment to scientific advancement and innovation.

Public Link:



Central Analytical Instrumentation Facility (CAIF) at Manipal Institute of Technology, MAHE



Central Animal Research Facility (CARF): This facility is pivotal for studies requiring animal models across different research disciplines. It offers a modern, two-corridor setup with sophisticated instruments for breeding, maintenance, and experimentation on animals.

Manipal Centre for Clinical Research (MCCR): Founded in 2010, the MCCR plays a crucial role in advancing clinical research endeavors. With divisions in Manipal and Mangalore, it coordinates sponsored trials across multiple hospitals, contributing significantly to Phase II, Phase III, and Phase IV clinical studies.

Central Research Laboratory (CRL): Established between 2003 and 2012, the CRL serves as a hub for interdisciplinary research activities. Equipped with state-of-the-art instruments and equipment, it facilitates collaborative projects spanning diverse scientific domains. Central Instrumentation Facility (CIF): The Innovation Centre at MIT Manipal houses the CIF, a comprehensive facility supporting multidisciplinary research areas such as material sciences, biosensors, and organic photovoltaics. It offers access to advanced instruments like Scanning Electron Microscope with Energy Dispersive Analysis (SEM-EDAX), Atomic Force Microscope (AFM), and others.

BioNEST Facility: Inaugurated with support from the Biotechnology Industry Research Assistance Council (BIRAC), the BioNEST facility is a testament to MAHE's commitment to fostering biotech entrepreneurship. It provides a nurturing environment for startups and entrepreneurs in biopharma, biomedical devices, healthcare, and diagnostics, fostering innovation and interdisciplinary collaboration.

Wilderness Medicine and Conservation Facility: MAHE Wilderness Medicine and Conservation Research Centre at Kanchinabailu, Manipal. This new center, a collaboration between MAHE's Centre for Wilderness Medicine, Department of Emergency Medicine, and Department of Emergency Medical Technology, signifies a strong commitment to advancing Wilderness Medicine and environmental conservation in India.

3D bioprinting and tissue culture facility launched

The Hindu Bureau MANUJALURU

The Manipal Centre for Biotherapeutics Research (MCBR), Mangalore, a constituent unit of Manipal Academy of Higher Education (MAHE), inaugurated the 3D bioprinting and tissue culture facility here on Tuesday.

MAHE Vice-Chancellor, M.D. Venkatesh, Pro Vice-Chancellor (Health Sciences) Sharath K. Rao, Genesis Packaging CSR Head Niral Vora, Director Kaushal Vora and others unveiled the facility. Dual nozzle 3D bioprinter (Anga Pro, Alfatex Systems) was procured from the CSR funds contributed by Genesis Packaging Pvt. Ltd., Udupi.

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“3D Bioprinting is the promising area of research where significant progress is being made in printing human tissues and organs.”

Mr. Niral Vora said “MCBR is a world-class research facility and we are extremely happy to contribute CSR funding to create state-of-the-art facility. We wish MCBR and MAHE researchers all the best in their research using the bioprinter.”

Udupi: Manipal Centre of Biotherapeutics Research Inaugurates 3D Bioprinting Facility

Tue, Mar 14 2023 06:15:28 PM

Media Release

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Richard O'Shea
Kannur News Network, 14-03-2023 16:30:22

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While inaugurating the facility Lt. General (Dr) M.D. Venkatesh, Vice-Chancellor MAHE said “3D Bioprinting is the promising area of research where significant progress is being made in printing human tissues and organs. I am glad to inaugurate the 3D Bioprinting and Tissue Culture Facility at MCBR and I look forward to seeing groundbreaking research to emerge from this facility ultimately benefiting humankind at large”.

Mr. Niral Vora, CSR Head of Genesis Packaging said “We are honoured and humbled to be associated by MAHE leadership. MCBR is a world-class research facility, and we are extremely happy to contribute CSR funding to procure the 3D Bioprinter, we wish MCBR and MAHE researchers all the best in their research using the bioprinter”. MAHE and Alfatex signed an agreement to collaborate on R&D development and innovative research in the area of 3D Bioprinting.”

Dr. Sharath K. Rao, Pro Vice-Chancellor (Health Sciences), MAHE, said “We are pleased to see the progress in 3D Bioprinting in India and the potential it holds”.

The event was presided by Dr. Raniga N.L., Professor and Coordinator of MCBR and the gathering was chaired by the vice-chancellor of MAHE, Dr. Shaath K. Rao. Associate Professor, and Team Leader 3D Bioprinting MCBR presented the research highlights in the area of 3D Bioprinting at MCBR. Dr. Niral Vora, CSR Head of Genesis Packaging, Dr. Kaushal Vora, Director, Genesis Packaging, and others were present. Mr. Prathap Kumar anchored the program and Mr. Nihal Vora presented the state of the facility.

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Public Link:

 [Manipal Centre of Biotherapeutics Research Inaugurated a 3D Bioprinting Facility](#)

Library Resources: MAHE boasts a network of **15 libraries**, fully equipped with modern amenities and digital resources. These libraries are not only repositories of knowledge but also hubs for interdisciplinary research, offering services like literature search, access to e-resources, and research/project support.

Collaborative Spaces: To encourage interaction and idea exchange among researchers, MAHE provides dedicated collaborative spaces like the **Idea Café** and **Excelerate in the Innovation Center**. These spaces serve as catalysts for interdisciplinary collaborations, fostering innovation and entrepreneurship.

In conclusion, MAHE's commitment to interdisciplinary research is evident through its state-of-the-art facilities, collaborative initiatives, and supportive ecosystem, enabling researchers to explore new frontiers and address complex societal challenges through interdisciplinary collaboration.

Research Facility @ MAHE

Manipal School of Life Science

FTIR Spectroscope



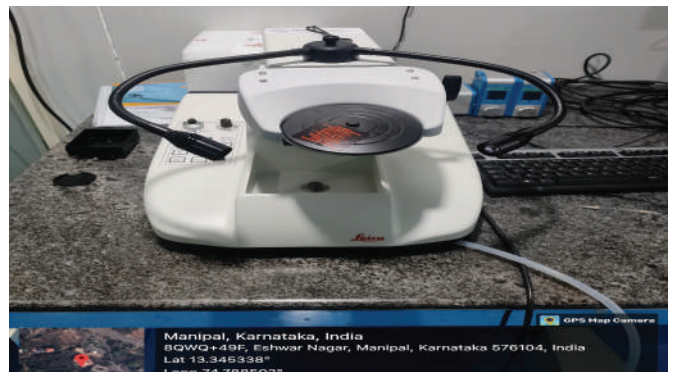
X-Ray Irradiator



High Performance Bench-Top Orbitrap Mass Spectrometer system



Leica VT000S (Microtome)



Seahorse Mini Analyser



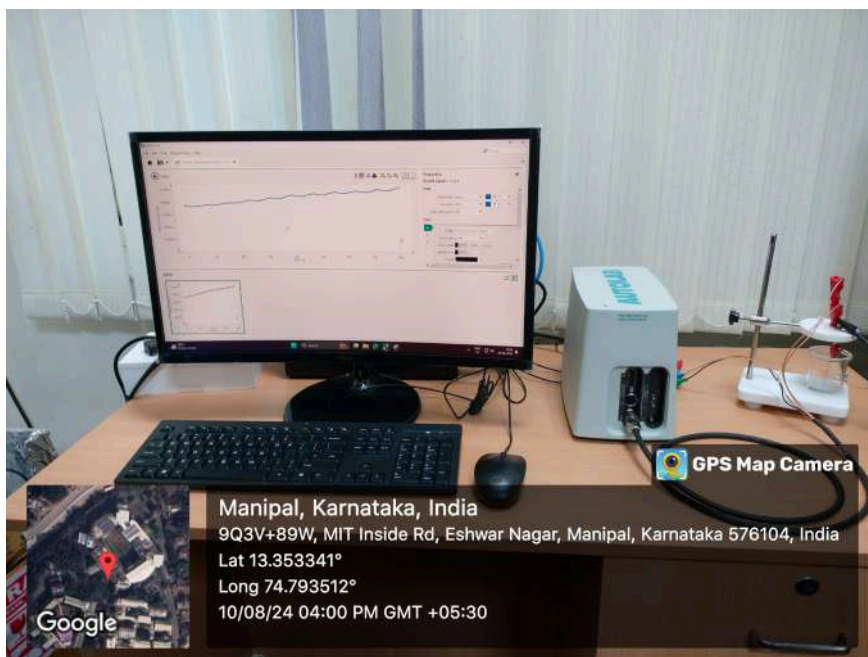
Fluorescence Upright Microscope



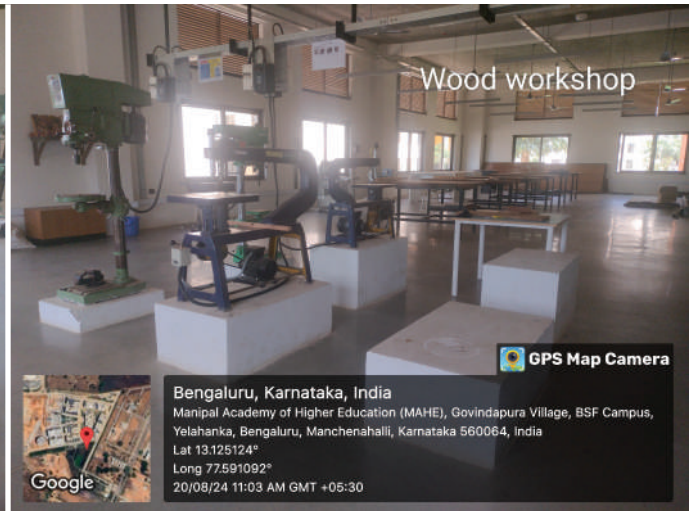
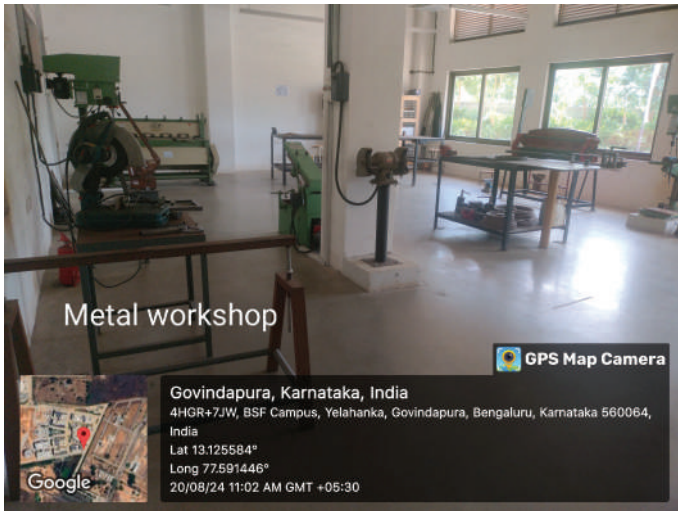
Manipal College of Dental Sciences



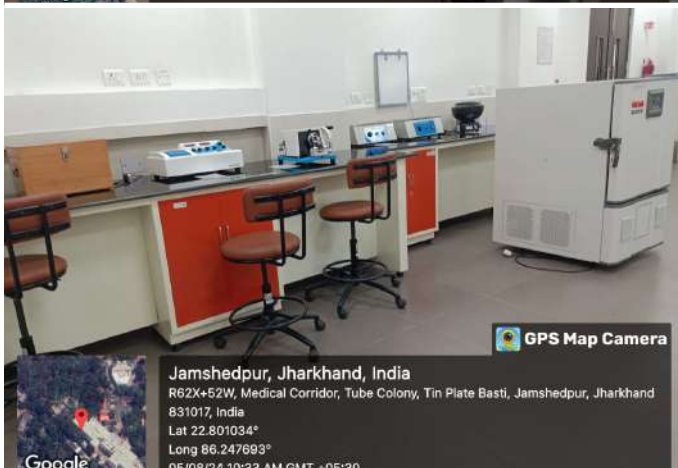
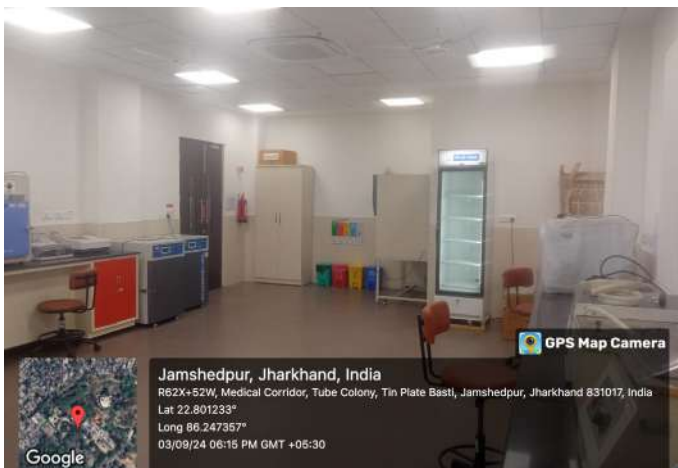
Department of Atomic and Molecular Physics

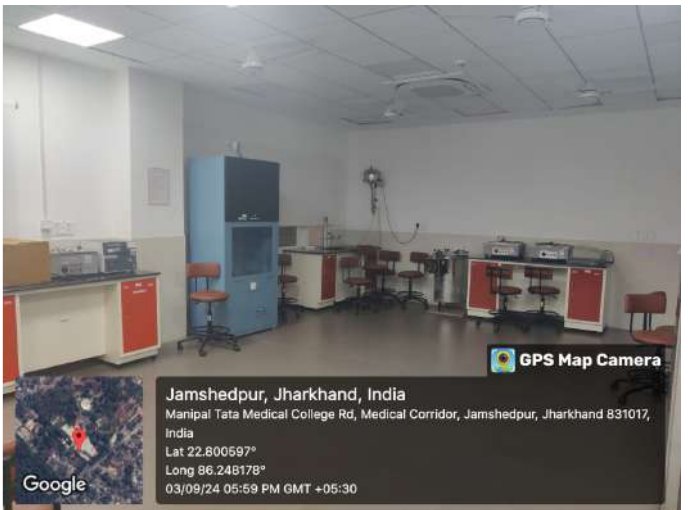
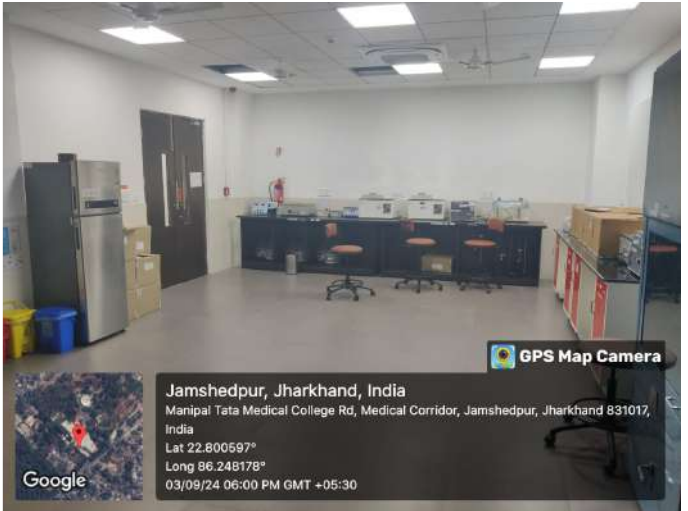
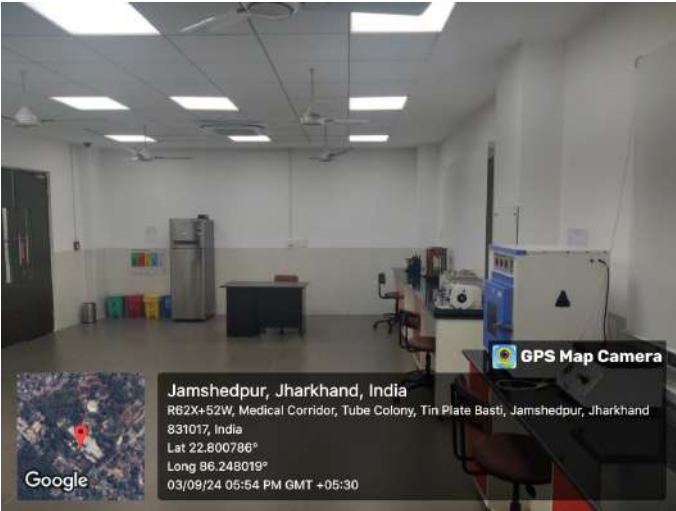
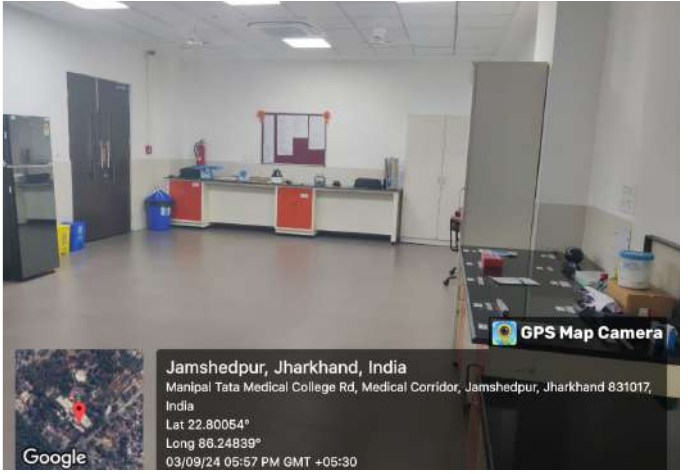






Manipal Tata Medical College (MTMC) Jamshedpur





Kasturba Medical College (KMC) Mangalore, a constituent unit of MAHE , Manipal

2022 – The Central Lab houses state-of-the-art diagnostic facilities of Kasturba Medical College and Hospital Mangaluru. The five floored building has a fully automated complete Lab integration system, one of the best in the country in terms of quality and modern technology to perform Immunoassays, Hormones, Hematology and Infectious Disease Serology on the premises



Manipal College of Dental Sciences (MCO DS) Mangalore, a constituent unit of MAHE , Manipal

Since its inception in 1987, Manipal College of Dental Sciences (MCO DS), Mangalore, is dedicated to dental education, patient care, and research. With a strong emphasis on advancing oral health and promoting interdisciplinary collaboration, MCO DS, Mangalore conducts diverse research activities aimed at improving dental treatments, oral health outcomes, and overall patient care.

RESEARCH FACILITIES

The 3D Cone Beam Computerized Tomography (3D CBCT) in MCO DS, Mangalore was the first fully loaded system installed in the country. The Surgical Skills Laboratory, the first of its kind in a dental institute in India, has life-size mannequins for hands-on preclinical training in injection techniques (local anaesthesia, IM/IV), tooth extraction, suturing techniques and basic life support. The state-of-the art surgical microscope and the CAD Cam equipment, 3D printers comprise the new equipment added to the inventory of MCO DS, Mangalore. The institute also provides faculty and students with digital research tools like Grammarly, Turnitin plagiarism software, Language editing services, Mendeley reference manager and full access to Office 365.

Manipal School of Life Sciences, Manipal, a constituent unit of MAHE , Manipal

- 1. Molecular Biology Laboratory:** Facilities necessary for all molecular biology related work is available in five separate laboratories, with routine instrumentations such as PCR thermocyclers (>8), Gel documentation systems (>4), Western blots, PFGE-SSCP apparatus, electrophoresis units, deep freezers, centrifuges etc.
- 2. Genetics Laboratory:** Genetics laboratory is equipped with tissue culture hoods, carbon dioxide incubators, microscope with karyotype/FISH software, water baths, incubators, gel apparatus, large databank of genetic disorders and different types of karyotypes abnormalities for various diseases and expertise available.
- 3. Mammalian Cell Culture Laboratory:** There are more than twenty fully equipped microscopes (including fluorescence) in tissue culture laboratories available for research, diagnostic and teaching purposes.
- 4. Microarray Facility:** Has Agilent microarray 2 micron scanner with bioanalyser and hybridization ovens to undertake microarray array analysis for high throughput gene expression, epigenetics and SNP analysis.



Microarray facility, MSLS

- 5. DNA Sequencing facility:** DNA sequencer ABI-3530 & ABI-3130 Genetic Analysers with 16 capillaries are available for sequence and fragment analysis purposes. Ion Torrent PGM Next Generation Sequencing (NGS) facility is also available, along with capability of Oxford Nanopore sequencing. In addition, it also hosts a Real-Time PCR thermocycler.



DNA Sequencing facility, Next Generation Sequencer (IonTorrent), MSLS



DNA Sequencing facility, Sanger Sequencer, MSLS

6. Flow Cytometry Facility: Flow cytometers (BD FACS Calibur) are available for Teaching, Research and Diagnostic purposes.



Flow Cytometer, MSLS

7. **Mass Spectrometry facility:** ESI-QTOF with HPLC for proteomics analysis is available. ICP-MS for heavy metal quantification is also available.



Mass Spectrometer & HPLC unit (LC-MS), MSLS

8. **Imaging Facility:** Fluorescent scanner and high resolution image capture microscopy.
9. **Microbiology Laboratory:** State-of-the-art microbiology laboratory with level II biosafety cabinet, BacTec® incubator, centrifuges, and shaker-incubator is available.
10. **Atomic Absorption Spectrometry Facility:** Used for elemental analysis (Lead, Mercury etc.) of clinical, environmental and biological samples.
11. **HPLC Laboratory:** Three separate HPLC machines with UV, visible, fluorescence, electrochemical and PD detectors are available.



HPLC unit, MSLS

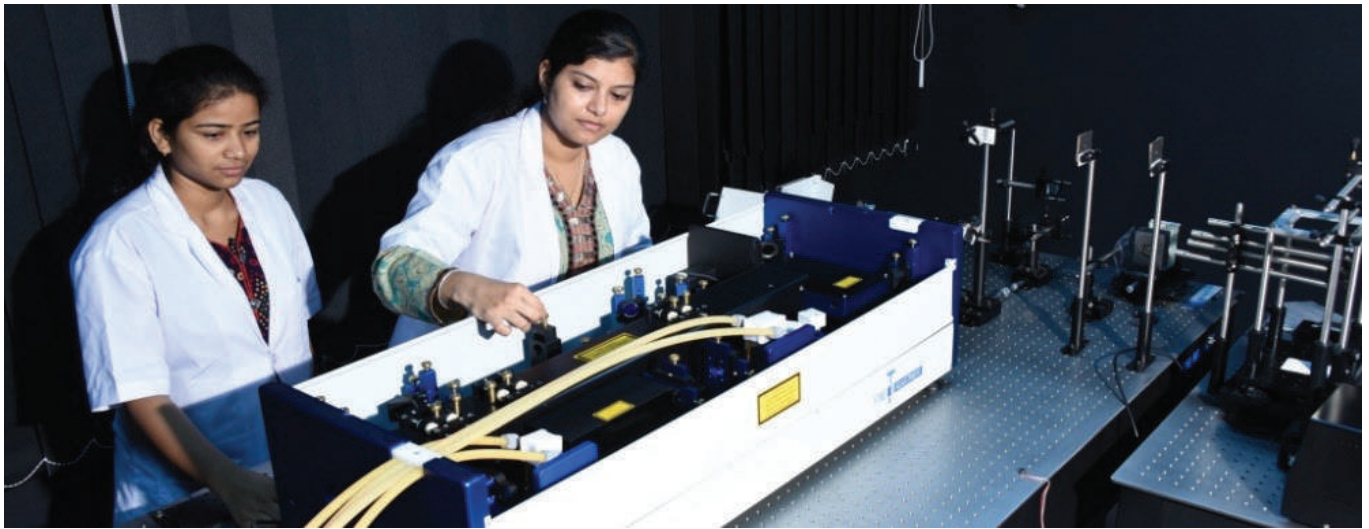
- 12. Radioisotope Facility:** Separate radioactive material handling facility with liquid scintillation counter, scanners etc. is available.
- 13. Biophysics Laboratory:** The Biophysics laboratory conducts experiments on biological/ pre-clinical/ clinical samples applying Laser Induced Fluorescence and Photoacoustic Spectroscopy to evaluate their spectral information related to diseased and non-diseased conditions. Experiments of Low Level Laser Therapy (LLLT) for tissue regeneration are also conducted in this laboratory.
- 14. Common Instrumentation Facility:** It consists of large scale bacterial incubator/shaker, high-speed and ultra-high speed centrifuges, frozen and paraffin block preparation microtomes.
- 15. Tissue Culture Facility:** Well-equipped tissue culture room for the maintenance of human normal and tumor cell lines, mouse tumor cells lines, and repository for experimentation.
- 16. Animal House Facility:** The centralized, state-of-the-art, air-conditioned animal house with separate breeding, experimentation and sterilization rooms with relevant instrumentations, mainly houses mice of various strains (Balb/c, Swiss albino, C57BL6) as well as rats.
- 17. Animal Tumor Facility:** Routine transplantable tumor maintenance for experimentation in the form of both solid (fibrosarcoma and melanoma), ascites form (Ehrlich, P388, Daltons lymphoma etc.) and nude mouse facility for growing xenograft tumors are available.
- 18. Genetic Toxicology and Analytical Facility:** With fluorescence (Olympus, Carl Zeiss) & light microscopes and image analysis systems, spectrophotometers (Shimadzu) for routine biochemical and cytotoxicity assays
- 19. Bioinformatics Lab:** Well equipped computers with Linux/Windows Operating System, and IBM Server system for data analysis (including big data) with a good storage capacity.
 - (a) **Computer Lab:** Computers with inbuilt Linux (Ubuntu, CentOS) and Windows operating systems, dedicated for student purposes.
 - (b) **Cluster Facility:** To analyze bulk data generated from the genomic, proteomic platforms and to host in-house bioinformatics tools, MSLS has a cluster of IBM, Dell, PGM and Proton servers.
 - (c) **Manipal Computational Biology Interface (MCBI):** Bioinformatics department has developed an in-house tool which connects Life Science Content Management System (LS-CMS), Local Blast programs, Post-epigenomic Analysis Pipeline and Mass spectrometry search engines etc. to analyze data locally. We use Python, Java, C++ as tool development programming and R, MatLab as statistical programming language.
- 20. Plant Biotechnology Lab:** Well-equipped culture room for the plant cell, tissue and organ culture for different experiments.

21. Green House Facility: MSLS has state-of-the-art independent green house of 40×80 feet in size for plant hardening of in vitro raised plantlets and for further experiments. Green house also has Confocal Microscope, MSLS 100 important medicinal plants for research purpose.

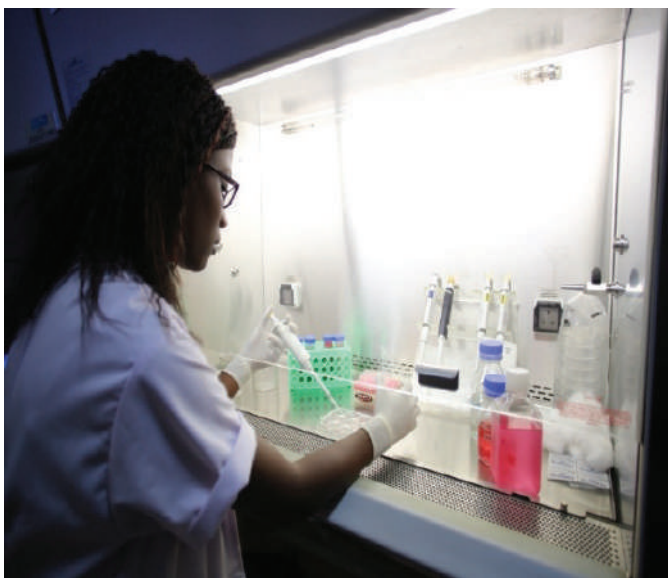


Confocal Microscope, MSLS

Laser Spectroscopy Facility, MSLS



Dye-laser Facility, MSLS



Animal Cell Culture Facility, MSLS



Animal Handling, MSLS



Plant Tissue Culture Facility and Greenhouse, MSLS



Protein Analysis Facility, MSLS



Bioinformatics Facility, MSLS



Research Laboratory, MSLS



Students' Laboratory MSLS

Manipal College of Pharmaceutical Sciences, Manipal

MCOPS has got the infrastructure to conduct research in the major discipline of pharmaceutical sciences which includes formulation development, drug discovery and development studies, molecular and cellular levels studies, herbal drug development, clinical research and quality assurance.

Formulation Development

Formulation Development is a key sector in the growth of the pharmaceutical industry. Thus, coming up with a new dosage form with appropriate drug delivery system to enhance patient compliance is a challenging task. The Department of Pharmaceutics at MCOPS has got state-of-the-art formulation development laboratories and infrastructure to carry out the research in the field. The following equipment is used to develop, evaluate and characterize the formulation in the following areas of Transdermal/ skin drug delivery systems, Oral dosage forms, Solubility enhancement techniques, Implants, Semisolid dosage forms, Ocular controlled systems, Dental preparations and Nanopharmaceuticals.

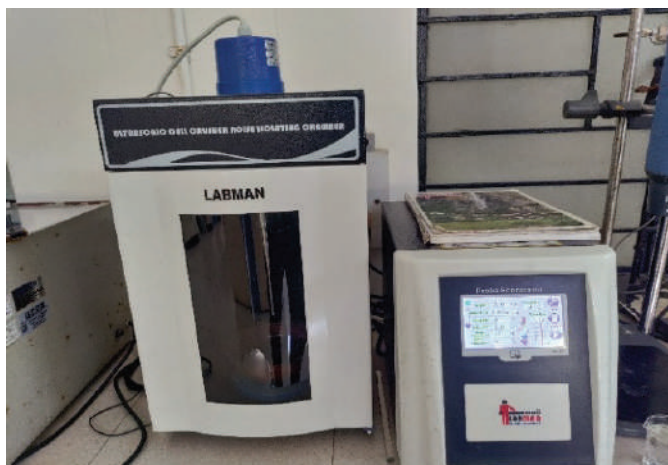
multisiflex C3, High Performance Liquid Chromatography, Differential Scanning Calorimetry, ATR-FTIR, Malvern Particle size analyzer, Fluidized Bed Processor, Freeze Drier, Rotary Evaporator, Nano-Ball Mill, Rotary Tablet Compression Machine, Colloid Mill, Tray Drier, Vacuum oven, Hot melt extruder, Milli-Q Water Purification Assembly, etc.



Emulsiflex C3, Avestin, Canada



Spray Dryer



Probe Sonicator



O-Micron 10P STEER Extruder

Drug Discovery and Development

Drug discovery and development is the crux of the pharmaceutical sciences. Even today a large number of diseases do not have medication to eliminate the disease/ disorder, for instance cancer, tuberculosis, malaria just to name a few. Therefore, there is a need for development of new chemicals with high safety margin and better efficacy profile. Three departments of MCOPS, namely, Pharmaceutical chemistry, Pharmacology and Pharmaceutical biotechnology are involved in drug discovery development related research. The major areas include design of new chemical entities in the field of anticancer, antihypertensive, antitubercular agents, diabetes, hyperlipidaemia, Inflammation, Wound repair, Neurological disorders, Radioprotection, etc. In the last several years the Department of Pharmacology and Department of Biotechnology have strengthened their infrastructure towards Molecular and Cellular Level Research. The major areas of research include anticancer, RNA interference, virology, antiaging, anti-obesity, neurological disorders and hepatoprotective activities. The infrastructure/ equipment available in these departments is as follows:

Molecular Modeling Facilities (Schrodinger), Parallel Synthesizer, Microwave Organic Synthesizer, Flash Chromatography, Biosafety Level II cabinets, CO2 Incubator, Liquid Nitrogen Storage Facility, Inverted Microscope, PCR Instrument, Microtiter Plate Reader with Fluorescence and Chemiluminescence, Microtiter Plate Washer, Autoanalyser, Western Blot, Electrophoresis Units, Lab Scale Fermenter, Orbital Shaker Incubators, HPLC, Powerlab Instrument, Microtome, Inverted Microscope with Fluorescent Attachment, Animal Tissue Culture Facility, etc.



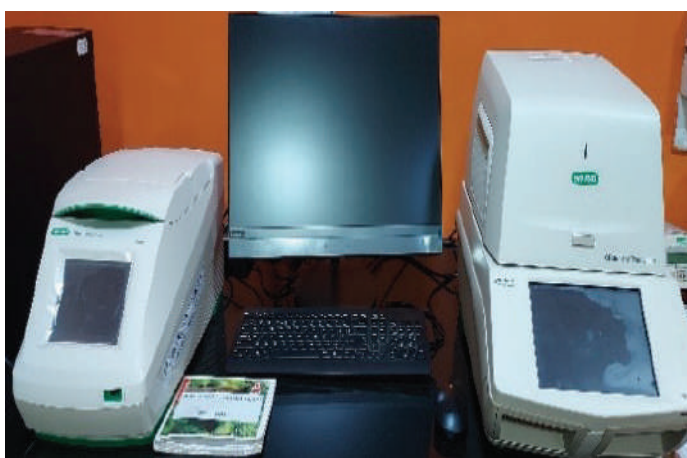
BD Accuri C6 flow cytometer



AGAPPE autoanalyzer



Western Blot units and Visualizer (G-Box)



Thermal Cycler, Real-Time System



Ultracentrifuge

Herbal Drug Development

The Department of Pharmacognosy has been actively engaged in the herbal research. With experienced well qualified faculty, the constant inputs for department improvement have resulted in excellent infrastructure and spacious well-equipped laboratories with sophisticated equipment especially crafted for herbal product development and evaluation. Dedicated labs for formulation development and evaluation comprising dissolution apparatus, HPLC, HPTLC and UV spectrophotometer are in place. The Department is equipped with required infrastructure as follows:

- Soxlet Apparatus, Freeze Drier, Rota-vapor, Large Scale Columns, Incubator for Plant Cell Biotechnology, HPTLC, etc.

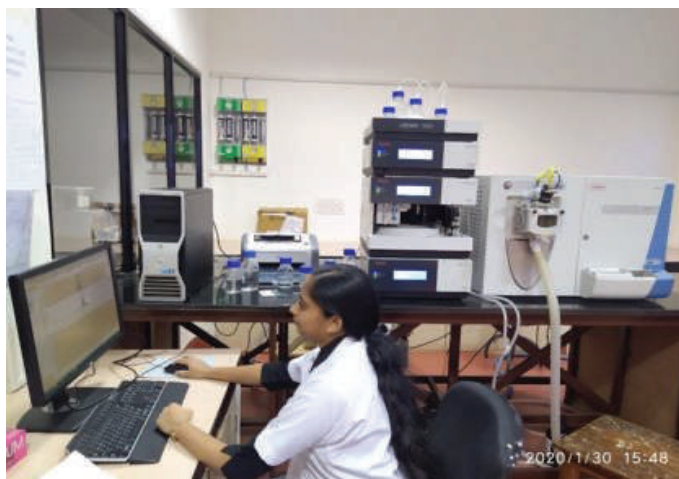
Clinical Research & Pharmacy Practice:

The Department of Pharmacy Practice is involved in the practice based research area by establishing various clinical services in the Kasturba Hospital Manipal. Drug information, adverse drug reaction and medication errors and clinical toxicology were the areas of research during the initial years. The department has expanded the scope of research from clinical to industrial areas like pharmacovigilance, clinical trials and regulatory affairs. Current thrust areas of research include pharmaceutical care, renal disease, respiratory disorders, patient safety, pharmacometrics, clinical toxicology, infectious disease and antibiotic stewardship and electronic documentation of pharmacy services and its impact on practice.

Quality Assurance

Analysis is an integral part of the drug discovery and development process. MCOPS boasts of one of the most sophisticated analytical facilities in an academic institution. The Department of Quality Assurance has the infrastructural and intellectual capability to meet any analytical development challenge. The research area includes Analytical and bio-analytical method development and validation, Drug Metabolism and Pharmacokinetic studies, Impurity profiling studies, Stability studies, Drug interaction studies, Bioavailability studies, Amorphous and crystal engineering studies etc. A brief list of instruments available in the department:

C-MS/MS, HPTLC, HPLC, GC-MS, FTIR, Differential Scanning Calorimeter, Ultracentrifuge, Milli-Q Water Purification Assembly, etc.



LC-MS



GC-MS



HPLC



DSC



SPECTROFLUORIMETER



KF- TITRATOR

Manipal Institute of Technology, Manipal



MIT-KEF R&D Center

In a move that will work towards providing a cutting edge research & development facility to upcoming civil engineering and architecture students, MAHE, a global player in education and health care, has tied up with KEF Holdings, a multinational holding company that specializes in innovative offsite construction technology, to set up a state of the art R&D Center. MIT-KEF R&D Center is built on the premises of the Manipal Institute of Technology, Manipal with a total investment of Rs 16 crores, with an equal contribution from both partners.

The facility covers a sprawling area of about 32,000 square feet, comprising several design studios, well equipped casting and testing laboratories for precast joints, beams and slabs, modelling and simulation laboratories, a conference hall, and a museum.

Department of Atomic and Molecular Physics, Manipal

A few major home-developed setup-based laboratories are functioning in the department that does advanced research in the areas of photonics/biophotonics/applied nanosciences.

1. Raman Spectroscopy Lab

Raman Spectroscopy is a vibrational spectroscopic method, used for biomedical applications including cancer diagnosis. Use of less harmful near IR radiation, along with efficient detection devices and advanced, versatile techniques makes this method most congenial for the purpose. Researchers at D.A.M.P. use the Raman spectroscopy method for the diagnosis of malignant, premalignant, and inflammatory conditions of oral malignancy in oral, cervical, breast, colon, and bladder tissues. Currently through the funding of SERB and DST, the Government of India, the department is integrating Raman spectroscopic techniques with plasmonics to develop a novel pathway to manipulate biological objects for developing new tools for disease identification and treatment. In addition, it is developing a novel optical liquid biopsy system based on Raman spectroscopic technique.

2. Optical Tweezer coupled with microfluidics and multi-modal spectroscopy

The research work in the Raman Tweezer lab involves the utilization of the developed Optical Tweezers set up that is coupled with Raman Spectroscopy/fluorescence spectroscopy for probing intercellular parameters, nanotoxicity, single biological cell, disease identification, etc.



Raman Tweezer Setup

3. HPLC-LIF Lab

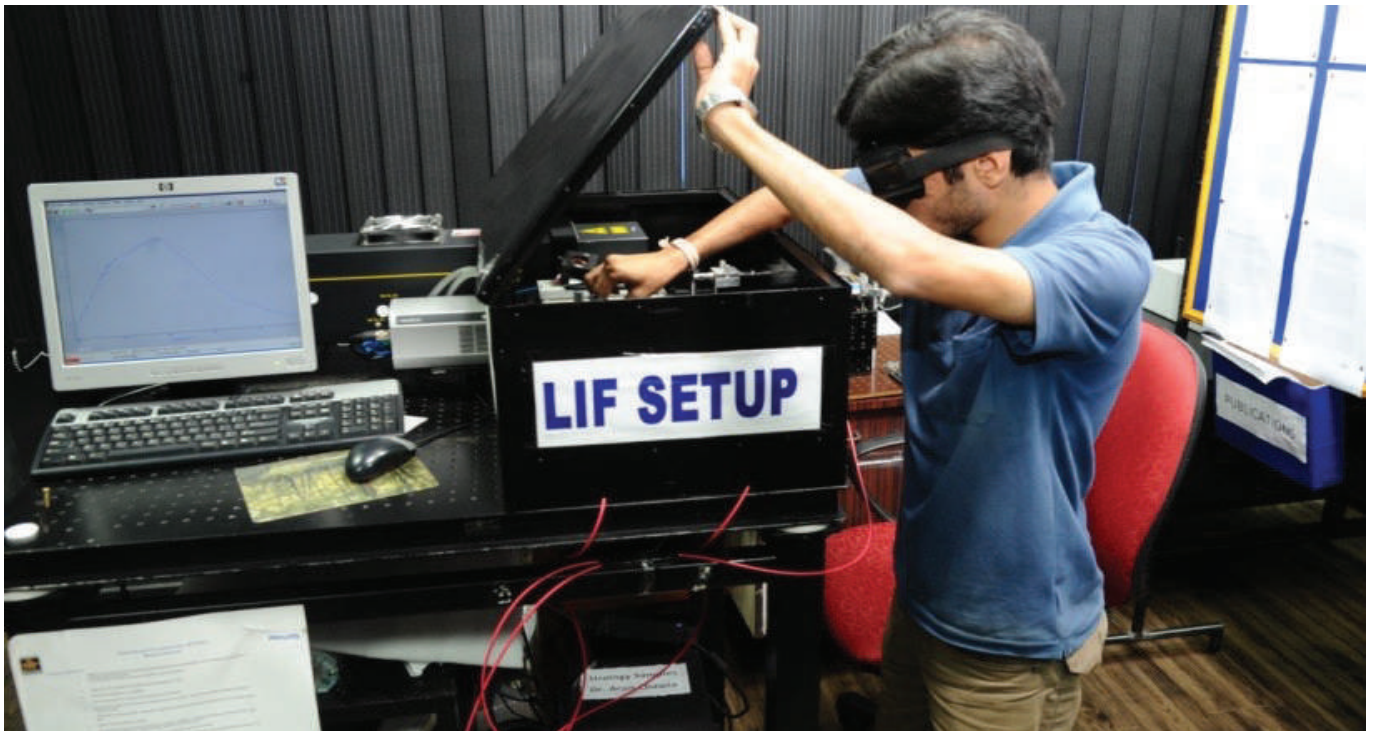
Efficacious studies with the High-Performance Liquid Chromatography- Laser Induced Fluorescence system have made possible the early detection of enzymes and surface molecules associated with tumor cells, thus enabling successful therapy in all types of malignancy. The studies also include analyses of body fluids to detect any kind of disease by making use of biological markers.



4. HPLC Setup Laser Induced Fluorescence (LIF) Lab

With the aid of funds from **Philips Research India, Bangalore** the D.A.M.P. team has developed a portable Laser Induced Fluorescence system for the early detection of oral cancer. The technique can detect and discriminate not only malignancy, but also potential malignant cases from the normal with good specificity and sensitivity.

The LIF system - designed, developed, and tested in this laboratory- uses a very sensitive spectroscopic concept of fluorescence, which looks out for the natural fluorescence from the tissue, which will be different for normal, malignant, and pre-malignant tissues. Presently the department is developing LED-based fluorescence that allows point-of-care screening of oral cancer.

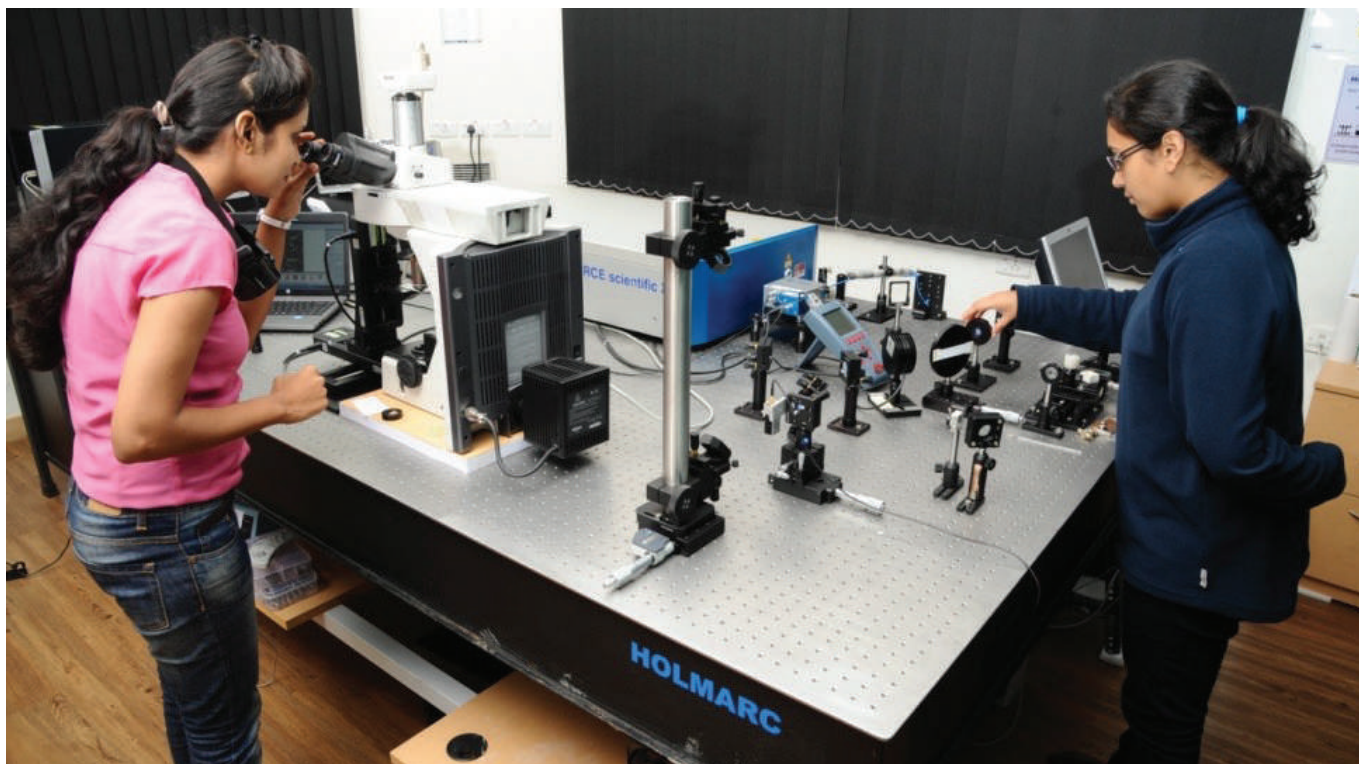


Setup for Laser Induced Fluorescence

5. Femtosecond Laser Lab

The Femtosecond laboratory at D.A.M.P. has two ultrashort laser oscillators. **Femtosecond scientific XL** delivers pulses as short as 50 fs with maximum pulse energy of 200 nJ at 5.2 MHz repetition rate. The laser operates at 800 nm central wavelength. The laboratory is equipped with a photonic crystal fiber for white light generation experiments, high precision three-dimensional motorized translational stages, high-resolution optical microscope, etc.

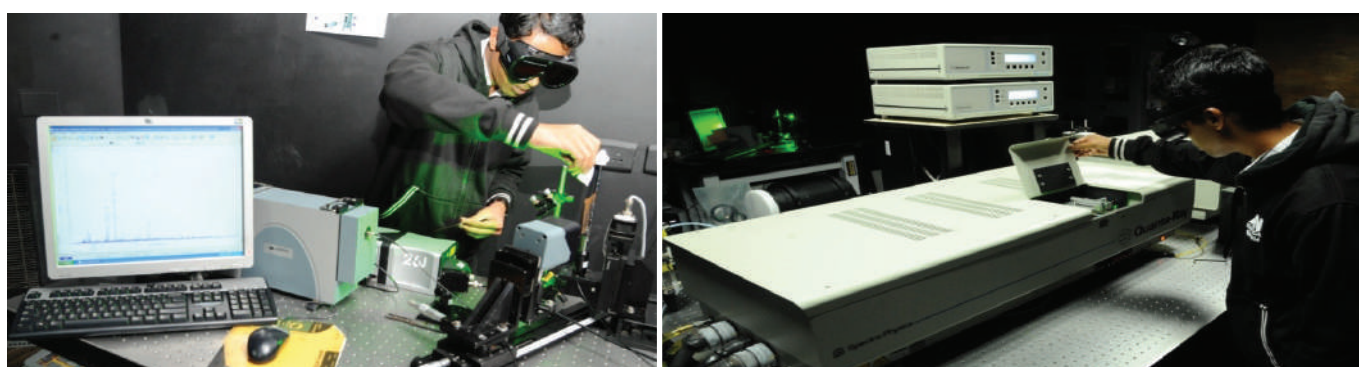
The project titled “Fabrication and submicron tailoring of materials for photonics applications with ultrafast lasers” funded by the Office of Principle Scientific Advisor, Government of India was successfully completed in 2013. The focus of the project work was the fabrication of active and passive waveguides inside transparent glasses for the telecommunication window using femtosecond lasers. Laser Induced Forward Transfer of thin films is another experiment being conducted here. This technique involves the transfer of metal from a donor thin film to an acceptor substrate that is kept sufficiently close to it. Micro patterns of metals, which have numerous applications in the field of microelectronics, can be deposited by this technique. The present activities of the lab include surface modifications and microfabrication of diffractive optical elements. With these the Femto team at D.A.M.P. seeks to develop integrated photonic circuits and devices.



Femtosecond Laser

6. Laser Induced Breakdown Spectroscopy (LIBS) Lab

An experimental setup has been developed for Laser Induced Breakdown Spectroscopy with the financial support of the Board of Research in Nuclear Sciences (BRNS), DAE, Govt. of India for the project on “Trace Element Analysis for Environmental and Biomedical Applications-Development of Laser-Induced Breakdown Spectroscopy (LIBS) Technique”. The project mainly focuses on trace element detection and quantification using LIBS in environmental, clinical, and radioactive waste samples. Specifically, it is proposed to quantify the trace elements in tissues, blood, serum, etc. from patients with cancer, diseases arising from elemental deficiencies, and heavy metal influences in therapy. Remote detection of hazardous samples using LIBS is another important goal of the LIBS group.



Setup for Laser Induced Breakdown Spectroscopy

The department has also initiated a Nanoscience program with the following research facilities.

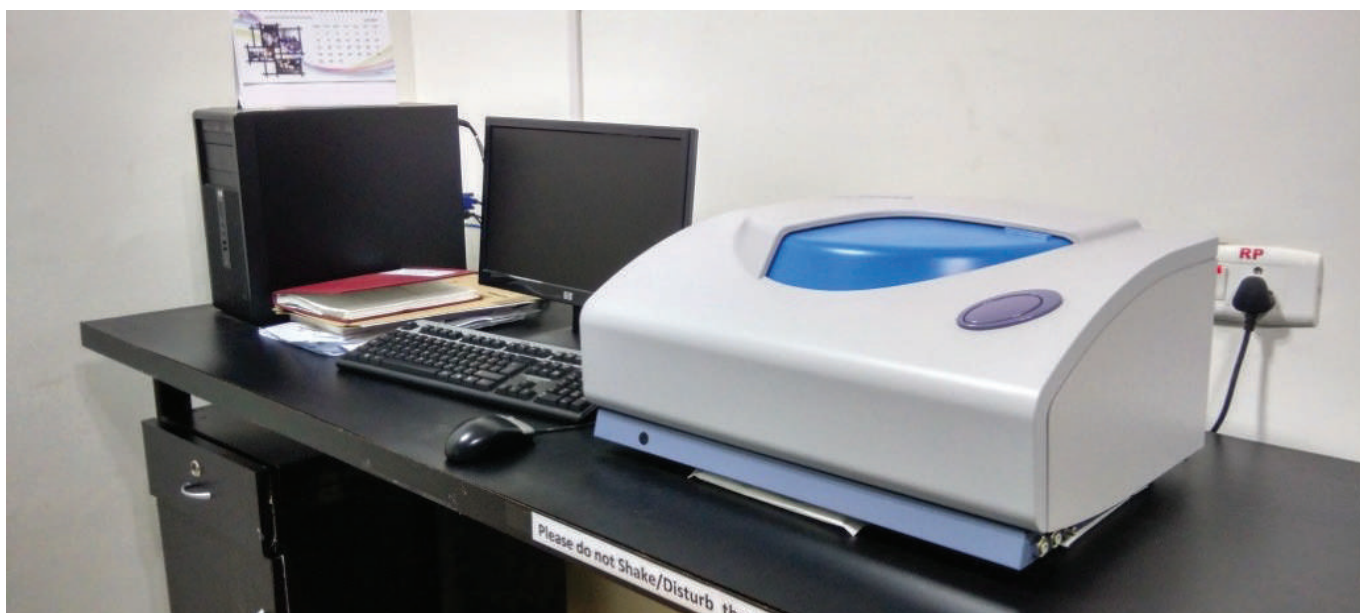
7. DST-FIST Nanobiophotonics Laboratory

The Department of Science and Technology, Government of India has recognized the department as a center for Nanobiophotonics by funding through the DST-FIST program. This lab is focused on the preparation and characterization of novel materials that include nanoparticles and up/down

conversion nanocrystals, with an aim towards future in-vitro as well as in-vivo imaging applications. The prepared nanoparticles of low toxicity allow imaging in the first and second biological window. Apart from this, the lab also prepares nanoporous alumina as well as metal oxide nanoparticles and exploits their applications in the field of photonics as well as bio/environmental sensing. The experimental equipment that forms a part of this lab includes an X-ray Powder Diffractometer, a microwave synthesizer, and a plasma polymerization unit. Through additional government funding (SERB, Government of India), the department has developed a rapid chemical vapour deposition system.



Microwave Synthesizer



Particle Size Measurement Instrument

8. Surface Wettability Tailoring Laboratory for practical applications

The adhesion or repellency of a surface to a water droplet/oil droplet/air bubble depends upon surface chemistry and surface roughness. In this lab, the department tailors the surface properties via physical and chemical methods to control the surface properties at the nanoscale, to have surfaces with tunable wettability. Such surfaces are proven to have applications such as self-cleaning surfaces, oil/water separation, controlled cell/bacterial growth, antimicrobial surfaces, droplet control and transport in digital microfluidics, development of plasmonic droplet assay etc. The work focuses on developing such surfaces for spectroscopic, digital microfluidics, and biomedical applications.



Setup for Contact Angle Measurement

9. Advanced Nanomaterials and Processing Laboratory

The research work includes the synthesis of various functional nanomaterials suitable for technological applications. Solution chemical methods are being developed for the rapid synthesis of these materials with suitable properties meeting application requirements. Special focus is on the thrust areas such as the development of spinel oxide phosphors for display applications and white light generation, development of nanoparticles for solar water purification technology, development of rapid pyrolysis method for Nanostructures and thin films, Thin film devices, and Gas sensing. The work also aims to develop and study the effect of thermal processing on the material properties. These research projects are funded by the Science and Engineering Research Board(SERB), DST, Govt. of India.



Plasma Polymeriser

10. Biophysics and Structural Biology Facilities

Structural studies of biological molecules include several steps such as cloning, transformation, expression, purification, crystallization, structure determination, molecular modelling, docking and dynamics. The department is highly equipped to carry out most of the biophysical analysis of small and macromolecules. The biophysics lab is equipped with Millipore water purification system, incubator shaker, water bath, and pH meter. With these instruments, we can clone, transform and express the desired proteins. Once the proteins are expressed, the purification is carried out using BIO-RAD Low-pressure Chromatography, followed by analysis using a Bio-Rad protein electrophoresis system. The protein crystallization is done using Hampton crystallization facilities, and it is analyzed using stereo microscope. The structure determination and drug identification are carried out with fast computing systems and software including CCP4, Phoenix, Shelex, WinGX, AMBER, PYMOL, CHIMERA, VMD, SWISS-MODEL, GAMESS, RESP and RED.



Chromatography set up and Stereo Microscope for protein purification and analysis

MANIPAL COLLEGE OF DENTAL SCIENCES, MANIPAL

The Manipal College of Dental Sciences, Manipal encourages and inculcates the culture of research among its faculty. Research is also an integral part of the undergraduate and postgraduate training. This is achieved through emphasis on training of faculty and students through regular awareness programs, training programs, workshops or through interaction with eminent researchers. In addition, the institution provides state-of-the-art research facilities, along with library facilities to encourage participation of all in research activities. The institution has identified thrust areas of research and faculty are provided with all the assistance needed to conduct research in these areas. Besides training, the institution also incentivizes research deliverables by faculty and students of the institution. This is facilitated through seed grants, conference facilities, article processing charges, incentives for publications and research grants, etc. Over the years, Manipal College of Dental Sciences, Manipal has significantly improved its research activities in the sphere of oral health care and contributed significantly to the thrust areas of research such as oral cancer, root canal irrigants, dental biomaterials, local drug delivery systems, etc.

Equipment and Lab Facilities available for research purpose at MCODES

▪ **Universal Testing Machine Instron -3366 (Year -2007)**

The Universal testing machine is used to test various types of stresses in materials like Compressive, Tensile & Flexural stresses. The Machine has a maximum load capacity of 10KN and can be used for testing shear bond strength & frictional forces with some modifications. The equipment is available for testing for students & faculty of MAHE, as well as testing of samples from other institutions on payment and with prior appointment.

▪ **Cone Beam Computed Tomography i-CAT platinum 17-19 –imaging International USA**

It is a three dimensional imaging modality with Multiplanar reconstruction as well as sectional slicing at lesser radiation exposure compared to Computed tomography. It is excellent in revealing hard tissue structures and abnormalities associated with orofacial region. It is also useful for research purposes using dry mandibles, quality materials and assessing the structural analysis of various polycarbonates.

▪ **Dental Microscope Model and make- Extaro 300 from Ziess (Year of purchase: 2020)**

Facilitates the clinician to magnify the vision up to 25 times that of the naked eye and improves the ergonomics. It aids in diagnosing caries, locating hidden and accessory canals, removing solid obturation materials & fractured instruments, management of endodontic mishaps, and facilitates all aspects of endodontic surgery.

▪ **KaVo DIAGNOcam 2170 U Intra-Oral Digital Camera**

Detects carious lesions easily and earlier with light waves and without X-ray radiation, suitable for patients of all ages

- Cracks that one cannot see with the naked eye become visible with DIFITI technology
- Simple to operate
- Real-time images for patient education and engagement
- Comfortable to use and increased patient comfort

▪ **PrepStart Air Abrasion System (2009)**

PrepStart™ air-treatment technology system offers anesthesia- and dental-bur-free dentistry in a minimally-invasive fashion. The unit achieves clean and smooth preparations, while also improving the bond strength to popular substrates, including Zirconia. PrepStart can be used to perform clinical functions, such as cleaning the margins and internal surface of preparations, removing stains, remnant restorative materials, or infected carious dentin or biofilm.

Features & Benefits:

- Minimally-invasive dentistry without a dental bur
- Anesthesia-free cavity preparation
- Cleaner and more conservative preparations
- Optimal patient comfort and clinical efficacy

▪ **Dental Bone surgery Unit: Acteon Peizotome Cube**

Fine bone surgery instrument for surgical tooth extraction and other osteotomy procedures.

▪ **Electrocautery Machine Covidine Force FX Electrosurgical Generator**

For all surgical procedures used for cutting, desiccating, and fulgurating tissue in monopolar and bipolar modes

- **Oscillating Saw:Stryker-FCCIO-Q9R-5400**
Used for Osteotomy Procedures of the jaw
- **Biostar Scheu-Dental GmbH, Germany – Biostar VI Machine -230 V**
Used to fabricate thermoform/vacuum invisible retainers
- **Physio Dispensor NSK SurgicPro SGL 70M**
Used for intra oral implants (Temporary anchorage devices) – palatal implants, buccal implants
- **Dolphin 3D software**
Visualization and analysis of craniofacial anatomy which helps to provide accurate guidance for evaluation of cephalometric landmarks and treatment planning.
Helps to study detailed treatment nuances; demonstrate the plan to the patient; or conduct case presentations for the surgical team.
- **Pentahead Microscope with inbuilt digital camera (Olympus microscope, BX 4)**
For academic teaching, slide discussions, diagnostic and research purpose.
- **Fluorescent Microscope**
A fluorescence microscope is an optical microscope that uses fluorescence to study the properties of organic or inorganic substances. Used for diagnostic and research purpose.
- **Stereomicroscope**
Stereomicroscope is a multipurpose instrument and used for several purposes in routine laboratory procedures like recording and examining solid samples with intricate surface details, and for research
- **Immunohistochemical Lab**
Well-equipped lab with facilities to carry out immunohistochemical and immunofluorescence staining.
- **CAD CAM MACHINE from Dentsply Sirona**
Installation of CAD/CAM (Computer Aided Designing Computer Aided Milling) system in the department has provided it with a higher level of predictability, efficiency, user friendliness and patient satisfaction. Digital Impressions with Primescan allows the institute to expand its treatment options and deliver faster and more accurate fixed dental solutions to its patients. It offers a flexible combination of software and hardware components, supported by an extensive range of material like Zirconia.
 1. Primescan Intraoral Scanner: for scanning intraoral images of patients
 2. inEos X5: desktop scanner used for scanning casts or impressions (extraoral scanner)
 3. inLab CAD Software: designing of the Prosthesis
 4. in Lab MC X5: Efficient milling unit
 5. inLab Profire sintering furnace: sintering of the milled prosthesis.

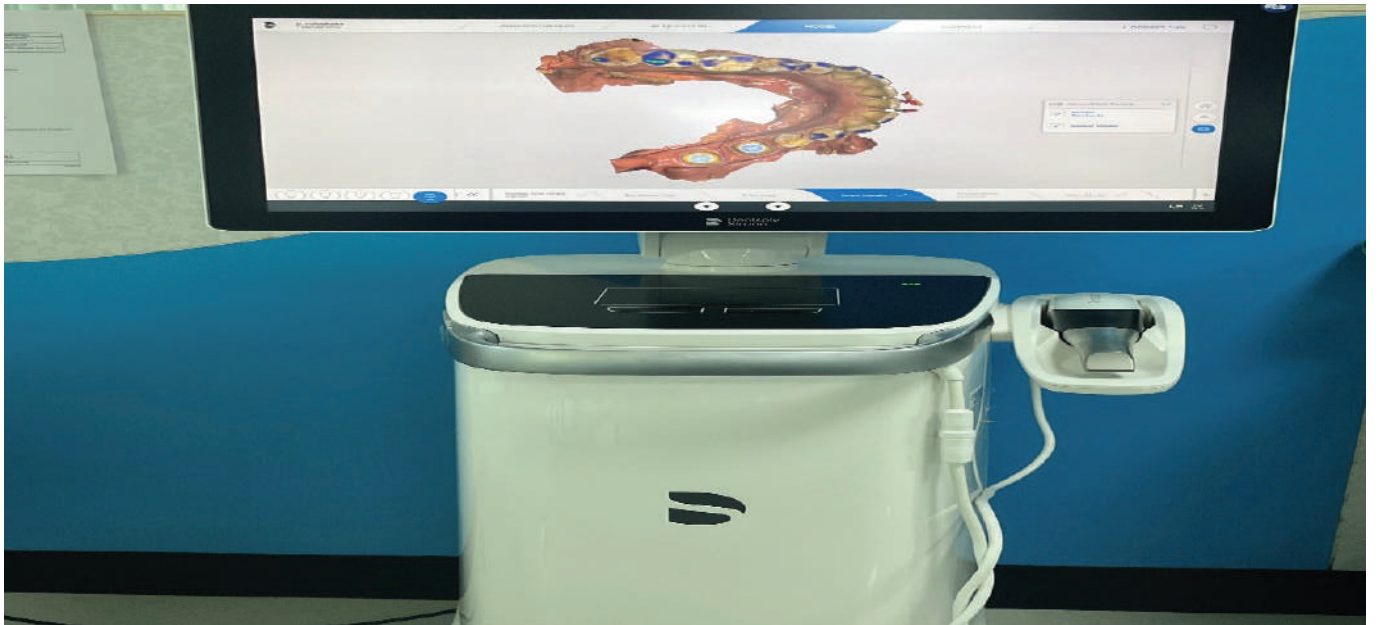


Image capturing with Intra Oral Scanner



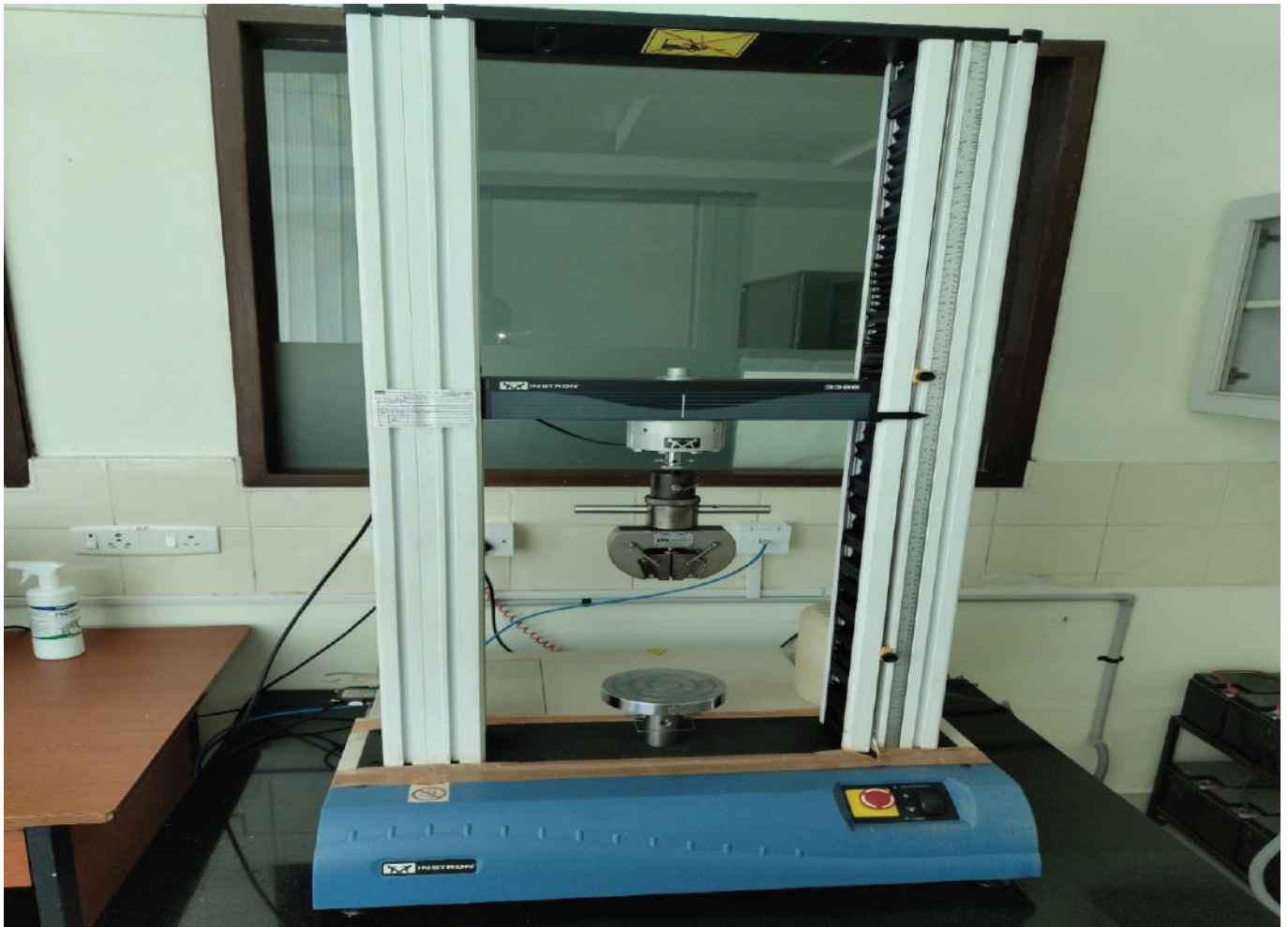
CAD CAM Lab



Fluorescence Microscope



Stereo Microscope



Instron Image

Manipal Institute of Regenerative Medicine (MIRM)

- A. The existing microscopy and the flow cytometry facilities at MIRM, Bengaluru were refurbished in 2019. The institute organized all the phase and fluorescence microscopes into the microscopy facility, upgraded the optical systems with modern optical devices, camera (stereoscope) and spares. The BD LSR II flow analyzer was first made functional and then upgraded with a new violet laser. The laser was a gift from Dr. William G. Telford from NCI, NIH, USA. This instrument is now a fully equipped 3 laser flow cytometer capable of various kinds of analytical experiments including multicolor immunophenotyping studies up to 8 fluorochrome parameters at a time.
- B. The “Make Your Own (MYO) Flow Cytometer” hands-on module along with Dr. William G. Telford. Dr. Telford heads the Flow Cytometry Core Laboratory at the Experimental Transplantation and Immunology Branch of the National Cancer Institute, at the National Institutes of Health, in Bethesda, USA. He is now an adjunct faculty in MIRM. The MYO is a gift from Dr. Telford from the NIH. This is an educational model, which he has created in his own laboratory to explain how every single component in a typical flow cytometer can be easily assembled on a bench to build a functional flow cytometer. A fully functional flow analyzer can be assembled “from ground up” and used to teach the principles and practical operation of flow cytometers. The entire process takes about two-three hours and is a very useful teaching module/tool for researchers.

c. An MoU was established with Luminex Corporation, USA to bring in an image flow cytometer (IFC) for MIRM on a contract for a year. It is a useful combination of two technologies i.e. a flow cytometer and a microscope on a single platform and its commercial value is about Rs 3 crores.

D. The DST FIST grant was sanctioned in 2019 to MIRM and the following is the list of equipment that got sanctioned and are assets of MIRM

Sl.No.	Equipment Name	Price
1	Micro Electrode Array (Model: 200817-MEA2100-90107; Make : MCS (Multichannel systems)	28.0 Lakhs
2	In utero Electroporation Unit (Model: 450661 ECM830 Safety; Stand System; Make: MARSAP)	10.0 Lakhs
3	Elispot Reader (Model: ELR08 ; Make : AID Classic)	22.0 Lakhs
4	Multimode Plate Reader (Model : Synergy H1 ; Make : Synergy)	18.0 Lakhs

Equipment available with the Institute (MIRM)

Generic name of equipment	Model, make and year of purchase	Remarks including accessories available and current usage of equipment
NanoFibre Electrospinning Unit	HO-NFES-040, Holmarc Opto-Mechanotronics Pvt Ltd. (2019)	Used for generating polymer nanofibres for preparing scaffolds
3D Bioprinter	INKREDIBLE+, CELLINK, Sweden (2020)	Used for Bioprinting hydrogels and cells
Flow Cytometer	BD LSR II, 3 laser analyzer, (2008) Imaging Flow cytometer (contractual)	Used by all labs in MIRM as core facility
Epifluorescence microscope	Nikon Eclipse TE2000 U with a Qicam Fast 1394 digital camera 2009	Used by all labs in MIRM as core facility
Centrifuge, Non-Refrigerated, Micro Samble	Thermo Electron LED GmbH Germany	Common facility
PCR System	Applied Bio Systems - USA	Common facility
Gel Documentation Systems	Alpha Innotech Corporation, USA	Common facility
Biosafety cabinet		In lab
Laminar Hood		Common facility

Physical facilities for Interdisciplinary Research



Innovation Center



NMR & RF-DC sputtering unit



Scanning Electron Microscope



Chromatographic



LINAC with SRS HD Versa



Fully integrated automated track system-Roche Cobas Pro and Sysmex XN9000

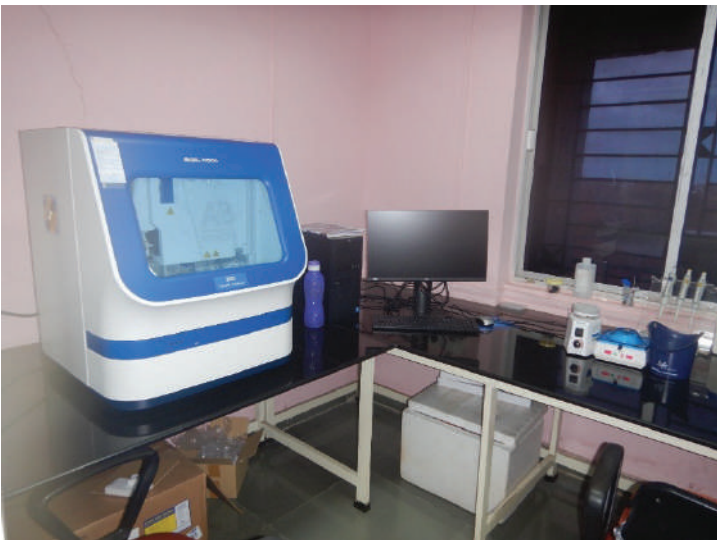


Digital Mammography –Helianthus DBT

Animal Tissue Culture Facility



Animal House Research Facility



Double Dye Laser Facility

Bionest Facility



DNA Sequencing (Sanger) facility



Raman Spectroscopy



Central Instrumentation Facility



Next Generation Sequencing Lab



Manipal Centre for Clinical Research



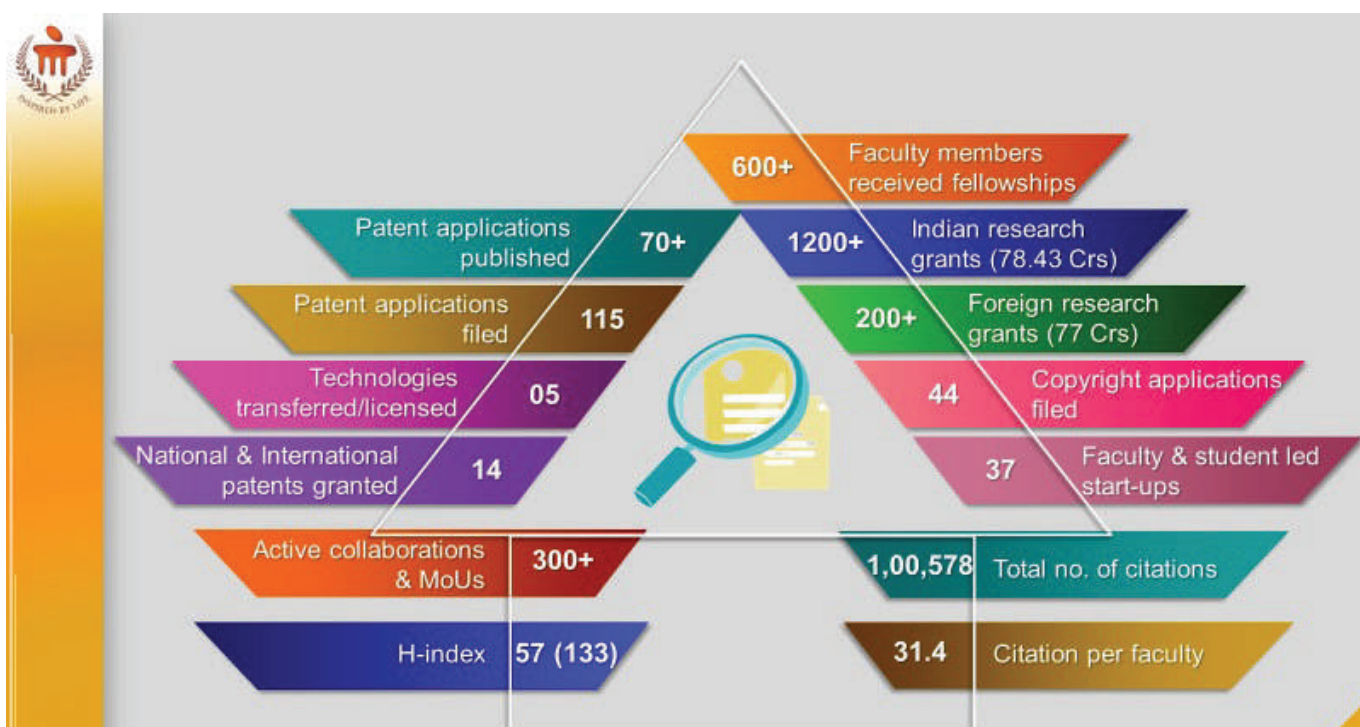
Central Instrumentation Facility



Manipal Centre for Biotherapeutic Research



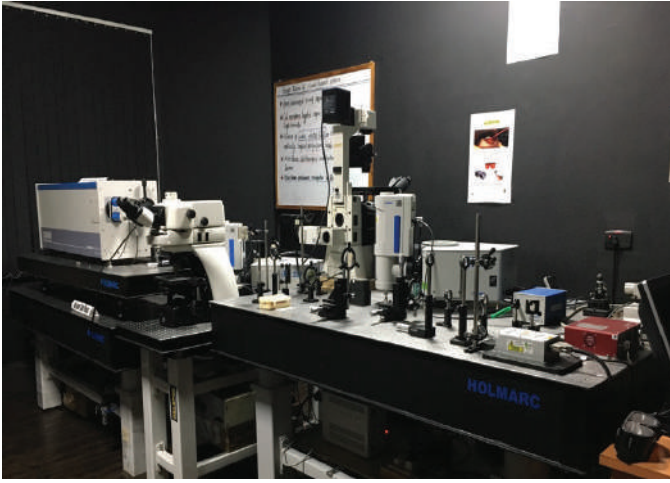
Manipal Centre for Biotherapeutic Clean Room



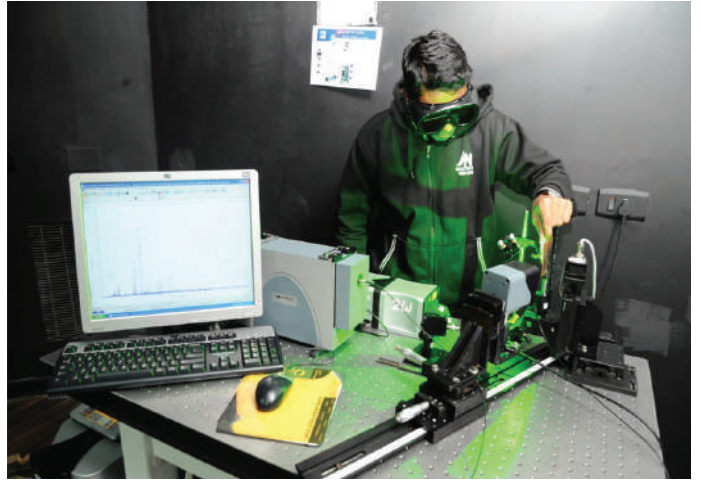
MIRM - Central facility for PhD



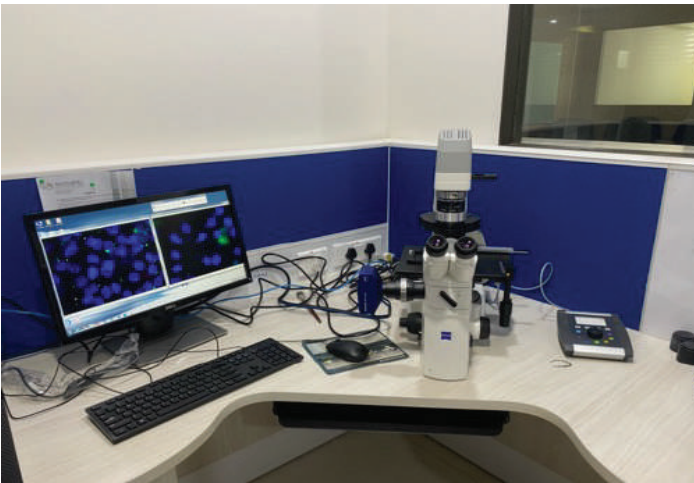
MIRM - Central facility for PG



Raman Tweezers setup



Trace Element Analysis facility



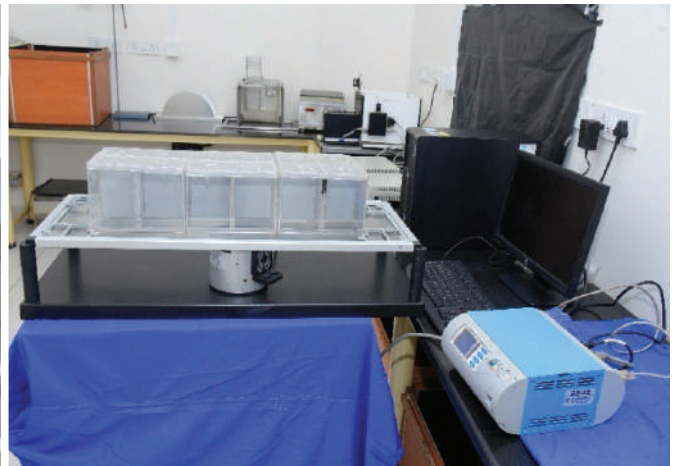
Axiovert A1 Fluoresc. Microscope



Serology Laboratory, MIV



IVC cages and Bio Safety Cabinet



Planter Test Machine



Nude Mice Breeding IVC Cages



Veterinary Blood Analyzer



Microtome



Manipal-GoK | BIRAC
Bioincubator | Bionest

Manipal Universal
Technology Business Incubator



MAHE Libraries

- Fully air-conditioned
- Group & Private study areas
- Remote Access facility for all students & faculty
- Audio Visual Section & Internet Kiosks
- Computer Labs

Individual Study Hall	Health Science Library														
MIT Library															
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