





HANDS-ON Training Program

"Advanced Trends in Biomedical Sciences: Research and Skill development"

(Bioscience for human health mission)

Under Synergistic Training Programme Utilizing the Scientific and Technological Infrastructure (STUTI)

> Organised by Department of Biophysics, Panjab University

in collaboration with Sophisticated Analytical Instrumentation Facility, Panjab University, Chandigarh (01st August to 07th August, 2022)

INAUGURAL PROGRAM SCHEDULE

VENUE: SEMINAR HALL, DEPTT. OF BIOPHYSICS, PANJAB UNIVERSITY, CHANDIGARH

TIME	PROGRAM
9:30 A.M	FORMAL WELCOME
	Dr. Simran Preet
	Convenor, STUTI Training Program
9:40 A.M	WELCOME ADDRESS
	Dr. Avneet Saini
	Coordinator, STUTI Training Program
	Chairperson, Deptt. Of Biophysics, Panjab
	University
9:50 A.M	INTRODUCTION TO DST STUTI SCHEME
	Prof. Ganga Ram Chaudhary
	PMU, STUTI Training Program
10:00 A.M	REMARKS BY
	Prof. Raj Kumar, Vice Chancellor, Panjab
	University
10:10 A.M	UNVEILING OF TRAINING PROGRAM
	BOOKLET
10:15 A. M	ADDRESS BY GUEST OF HONOUR
	Dr. Arindam Bhattacharyya
	Department of Science and Technology, India
10: 25 A.M	INAUGURAL ADDRESS BY CHIEF GUEST
	Dr. Sanjeev Khosla
	Director, IMTECH
10:35 A.M	HONOURING THE DIGNITARIES
10:40 A.M	VOTE OF THANKS
	Dr. Simran Preet
	Convenor, STUTI Training Program
10:45A.M	NATIONAL ANTHEM
10:50 A.M	HIGH TEA



Professor Raj Kumar Vice Chancellor Panjab University Chandigarh, India 160014



Message

A warm welcome to all the participants of the Seven Days Training Program entitled "Advanced Trends in Biomedical Sciences: Research and Skill Development" (Bioscience for human health mission) under the aegis of Synergistic Training Program Utilizing the Scientific and Technological Infrastructure (STUTI), an initiative of Department of Science and Technology (DST) at Panjab University, Chandigarh. This would be an indeed worthy platform which has been designed to cater to human resource and its capacity building through open access to Science &Technology Infrastructure across the country by organizing short term courses/ workshops on the awareness, use and application of various instruments and analytical techniques.

I congratulate the Sophisticated Analytical Facility (SAIF)/Central Instrumentation Laboratory (CIL), Panjab University, Chandigarh for being selected as the Project Management Unit (PMU) and performing their role as the hub manager for the STUTI program in the region. I would like to congratulate Department of Biophysics for taking initiatives and advantage of such opportunities to host these Hand on Training. I am elated to see the interdisciplinary amalgamation wherein the organizers from different fields collaborate as one team.

Techniques involving tissue processing for disease diagnosis as well as prognosis, cell culture, molecular biology, use of animal models for development of an *in vivo* disease complications and spectroscopy will strengthen various fields in broadening their research. Apart from this, it will aid various researchers and scientists to collaborate with each other in order to utilize their expertise. The program sensitizes the candidates with important biomedical techniques which is relevant and in line with the Bioscience for human health mission as the program is also involving the real time PCR technique which indeed proved to be the pivotal testing technique in COVID and still is.

I wish endeavors of the organizing team/committee will be fruitful accomplishment and event to be successful in all respects.

(Prof. Raj Kumar)



Dr. Arindam Bhattacharya Scientist at DST, India

Department of Science and Technology Ministry of Science and Technology



MESSAGE

Dear Participants,

Greetings

I am delighted and overwhelmed with the ongoing success of STUTI program so far. The real motive of the scheme "Synergistic training program utilizing the scientific and technological infrastructure" (STUTI) is intended to build human resource and its knowledge capacity through open access S&T infrastructure which has been thoroughly achieved through these training programs.

As a complement to the various schemes of DST funding for expansion of R&D Infrastructure at academic institutions, STUTI scheme focuses on hands-on training program and sensitization of the state-of-the-art equipment as well as sharing while ensuring transparent access of S&T facilities at various institutes.

This training program will impart practical hands-on training on sophisticated instruments. I strongly feel that this particular program on "Advanced Trends in Biomedical Sciences: Research and Skill Development" will be fruitful to multidisciplinary fields. The current hands on training program could undoubtedly be another milestone in DST's initiative towards building human resources through STUTI.

I congratulate the coordinators and the organizing committee for working hard and ensures the success of the seven days training program at Panjab University campus.

I wish you all a happy and successful training program.

(Dr. Arindam Bhattacharya)



Prof. Ganga Ram Chaudhary Director, SAIF

Panjab University Chandigarh, India 160014



MESSAGE

Dear Participants,

Greetings from SAIF, PU, Chandigarh

I feel delighted on occasion of STUTI training program. This DST scheme envisions hands on training programs and sensitization of the state - of - the - art equipment as well as towards sharing while ensuring transparent access of S & T facilities. Sophisticated Analytical Instrumentation Facility (SAIF) Panjab University feel proud to be part of this program. Our department is always striving for prompt services and quality analysis to support researchers from academia, R & D labs and industries from all over India.

The centre houses 25 state of art analytical instruments with high upkeep time; workshop facilities to repair analytical instruments and postgraduate courses like M.Tech. (Instrumentation) and M.Sc. (Instrumentation).

This training program will impart practical hands - on training on sophisticated instruments, I strongly feel that after going through this program on "Advanced Trends in Biomedical Sciences: Research and Skill Development" the participants will be able to use these instruments more effectively in their research. This will not only improve the quality of research but also help in optimum utilization of instrumentation facilities at their institutes.

With best wishes

(Prof. G.R. Chaudhary)



Dr. Avneet Saini Chairperson Department of Biophysics Panjab University, Chandigarh



MESSAGE

Dear Participants,

It is my privilege to welcome you all to one of the most prestigious University of North India-Panjab University, Chandigarh. These seven days training programme on "Advanced Trends in Biomedical Sciences: Research and Skill Development", is being organized by The Department of Biophysics, Panjab University, under the aegis of STUTI in collaboration with SAIF / CIL, Panjab University.

This training program will surely help young researchers with the basic as well as advanced techniques in Basic Medical Sciences and Research. The Training curriculum including hands on training sessions with experimental animals, establishment of *in vivo* disease models in rats/mice, tissue histopathology, cell culture techniques, molecular biology techniques and last but not the least the session on computational resources would be one of its kind where we will start from *in silico* resources/software's and take participants through the journey of designing molecules to *in vitro* and *in vivo* study models. The extensive application of *in vitro* assays, *in vivo* studies, CD spectroscopy, NMR in modern day drug discovery and research are the backbone of this training program. These sessions would help students and researchers in multidisciplinary fields to gain a better understanding of the various techniques. I am sure each one of you shall gain from this workshop and it shall be helpful in honing your research skills.

In addition, I must mention that the support and assistance from our colleagues at SAIF /CIL, faculty members, staff and students at the Department of Biophysics has been the strong driving force behind organizing this program. I extend my sincere thanks to each one of them for their cooperation, support and hard work.

(Chairperson)



Dr. Simran Preet Convenor



Department of Biophysics Panjab University, Chandigarh

MESSAGE

On behalf of the organizing Committee, it is an honor and pleasure to officially welcome you to the Training Program.

The Training program encompasses experimental animal-based disease model development training, basics of *in vivo* studies, tissue histopathology (processing and visualization), cell culturebased methods, molecular biology and Bioinformatics based techniques, CD spectroscopy and NMR. that are used extensively in modern day new molecules discovery, research and development and diagnostics. This field overlaps with other areas of biology, material science, pharmaceutical sciences and many more. This training program will primarily help the participants who are seeking basic and advanced level training in basic medical sciences-based techniques to get insight into their research and other industrial based technical operations. The training program enhances the working horizon among faculty, post-doc fellows, PhD Fellow. The scope of the training program is also extended to the industrial persons who are extensively involved in new molecules production and their detailed qualitative and quantitative descriptions. This training program will play a vital role in understanding mechanisms of new molecules, their actions and efficacy that can be used to efficiently to develop newer disease targeted drugs. This puts light on the increasing importance of *in vivo*, *in vitro* and *in silico* studies for the development of any newer drug or any other agent in research. In this scenario, organizing such a workshop would help the emerging students and researchers in multidisciplinary fields to gain a better understanding of basic methods in biology.

We hope that this training program will stimulate new ideas and approaches for pursuing their respective research and enhance skills in the field. We wish all delegates a fruitful attendance and involvement in the excellent event and hope that this training program is productive. Thank you for your participation and we wish you a very enjoyable stay in Chandigarh.

(Dr. Simran Preet)



PANJAB UNIVERSITY, CHANDIGARH

One of the oldest Universities in India, the Panjab University (PU) initiated at Lahore in 1882, has a long tradition of pursuing excellence in teaching and research in science and technology, humanities, social sciences, performing arts and sports. The University supports excellence and innovation in academic programmes, promotes excellence in research, scholarship and teaching. In Independent India, Panjab University with its Campus at Chandigarh and nearly two hundred colleges in Punjab state and Chandigarh U.T., has served various societal needs with distinction. The glorious traditions of the University established during the period of more than 133 years of its long service to the nation since its inception are a source of inspiration for the present generation of faculty members and students.

In Chandigarh, the newly built capital of Punjab, a beautiful red sandstone campus was designed for the Panjab University by Pierre Jeanneret under the general guidance of Le Corbusier. Panjab University moved here during 1958-1960. The Panjab University Campus at Chandigarh accommodates seventy-three teaching and research departments/institutes/Centres besides four independent Chairs for research. Furthermore, the university has 189 affiliated/constituent colleges spread over Punjab and Chandigarh besides Regional Centres at Muktsar, Ludhiana, Hoshiarpur and Kauni. The layout of two campuses of the University has been conceived to meet the academic, administrative, sports/recreational, residential and other requirements of a growing University.

The University has been recognized by the UGC as the "University with Potential for Excellence in Biomedical Sciences" with facilities for Stem Cell Research and Drug Development. During the 11th Five Year Plan (2007-2012), it was awarded the following two Centres of Excellence by the UGC under the Scheme of Centre with Potential for Excellence in a Particular Area (CPEPA): Centre of Excellence in "Application of Nano Materials, Nano Particles and Nano Composites" and Centre of Excellence in "Cultural Fixation on Honor: A Gender Audit of Punjab and Haryana".

The University is participating in various prestigious International High Energy Research Programmes at Fermilab (USA), KEK (Japan) and CERN (Switzerland). At present, the University is involved in a big way in CMS and ALICE Experiments at CERN (European Organization for Nuclear Research) Switzerland and Neutrino Programme at Fermilab, USA. The CMS (Compact Muon Solenoid) project at the Large Hadron Collider is for the discovery of Higgs Boson and other new particles. Under such International Research programs, the University had earlier been involved in the Top Quark Discovery (1995) and CP-violation discovery (2001).

International Collaborations: The University recently signed MoUs with University of Nottingham (UK), University of Birmingham (UK), Nottingham Trent University (UK) and University of Western Sydney (Australia). PU also has collaborations with National Science Technology and Development Agency, Thailand; University of Missouri, USA and Universidade de Aveiro, Portugal; International Crops Research Institute for Semi-Arid Tropics (ICRISAT), Hyderabad; International Centre for Agricultural Research in Dry Areas (ICARDA), Morocco for a joint collaborative project funded by the Consultative group on International Agricultural Research (CGIAR) consortium, funded by organisations such as UNDP and FAO, USA, UK, and Germany; International Centre for Agricultural Research in Dry Areas (ICARDA), Morocco; World Vegetable Research Centre, Taiwan through its South Asia Centre at Hyderabad and Baylor Medical centre, Dallas, U.S.A.

National collaborations: The University has various prestigious collaborations with a number of national institutes like Indian Agricultural Research Institute, Delhi; GB Pant University of Agriculture and Technology, Pantnagar; Himalayan Forest Research Institute, Shimla; IIT, Roorkee; PGIMER, Chandigarh; Nuclear Science, Delhi; IMTECH; CSIO, Chandigarh; Institute of Nuclear Medicine and Allied Sciences (INMAS), New Delhi; Jamia Hamdard University, Delhi; Atomic Energy Regulatory Board of India, Mumbai; Central University, Hyderabad; Agriculture University, Palampur; Inter University Consortium (Kolkata & Bhubaneswar).

Prominent Research Funding: The University is getting liberal grants for pursuing research from various national & international agencies. Recently, the Department of Science and Technology, Government of India, selected the Panjab University as one among the top fourteen universities of India for further funding under the Promotion of University Research and Scientific Excellence (DST-PURSE) programme. Under this prestigious scheme, the university will receive Rs. 34.8 crore for the development of research infrastructure, which could be utilized in the period from 2014 to 2018, of which Rs. 6 crore has already been received during 2014. To participate in the CMS project, the Department of Science and Technology and the Department of Atomic Energy have provided Rs. 19 crore for the Twelfth Five-Year Plan.





DEPARTMENT OF SCIENCE AND TECHNOLOGY

Department of Science & Technology (DST) was established in May 1971, with the objective of promoting new areas of Science & Technology and to play the role of a nodal department for organising, coordinating and promoting S&T activities in the country. The Department has major responsibilities for specific projects and programmes i.e Formulation of policies relating to Science and Technology, Matters relating to the Scientific Advisory Committee of the Cabinet (SACC), Promotion of new areas of Science and Technology with special emphasis on emerging areas, Research and Development through its research institutions or laboratories for development of indigenous technologies concerning bio-fuel production, processing, standardization and applications, in co-ordination with the concerned Ministry or Department, Research and Development activities to promote utilization of by-products to development value added chemicals, Futurology, Coordination and integration of areas of Science & Technology having cross-sectoral linkages in which a number of institutions and departments have interest and capabilities, Undertaking or financially sponsoring scientific and technological surveys, research design and development, where necessary, Support and Grants-in-aid to Scientific Research Institutions, Scientific Associations and Bodies, All matters concerning Science and Engineering Research Council, Technology Development Board and related Acts such as the Research and Development Cess Act, 1986 (32 of 1986) and the Technology Development Board Act, 1995 (44 of 1995), National Council for Science and Technology Communication, National Science and Technology Entrepreneurship Development Board, International Science and Technology Cooperation including appointment of scientific attaches abroad (These functions shall be exercised in close cooperation with the Ministry of External Affairs), Autonomous Science and Technology Institutions relating to the subject under the Department of Science and Technology

including Institute of Astro-physics, and Institute of Geo-magnetism, Professional Science Academies promoted and funded by Department of Science and Technology, The Survey of India, and National Atlas and Thematic Mapping Organisation, National Spatial Data Infrastructure and promotion of G.I.S, The National Innovation Foundation, Ahmedabad, Matters commonly affecting Scientific and technological departments/organisations/ institutions e.g. financial, personnel, purchase and import policies and practices, Management Information Systems for Science and Technology and coordination thereof, Matters regarding Inter-Agency/Inter-Departmental coordination for evolving science and technology missions, Matters concerning domestic technology particularly the promotion of ventures involving the commercialization of such technology other than those under the Department of Scientific and Industrial Research, All other measures needed for the promotion of science and technology and their application to the development and security of the nation, Matters relating to institutional Science and Technology capacity building including setting up of new institutions and institutional infrastructure, Promotion of Science and Technology at the State, District, and Village levels for grass-roots development through State Science and Technology Councils and other mechanisms, Application of Science and Technology for weaker sections, women and other disadvantaged sections of Society.



SYNERGISTIC TRAINING PROGRAM UTILIZING THE SCIENTIFIC AND TECHNOLOGICAL INFRASTRUCTURE (STUTI)

The Scheme 'Synergistic Training program Utilizing the Scientific and Technological Infrastructure' (STUTI) is intended to build human resource and its knowledge capacity through open access S&T Infrastructure across the country. As a complement to the various schemes of DST funding for expansion of R&D Infrastructure at academic institutions, STUTI scheme envisions a hands-on training program and sensitization of the state-of-the-art equipment as well as towards sharing while ensuring transparent access of S&T facilities.

DEPARTMENT OF BIOPHYSICS

The Department of Biophysics at Panjab University was established in the year 1964 with a vision to strengthen the field of Basic Medical Science of Panjab University. It originated with Electro-Physiology, Radiation Biophysics and Electron Microscopy. Apart from the traditional areas in Biophysics such as Cell and Molecular Biophysics, Radiation Biophysics, Membrane Biophysics and Neuro-Biophysics, the Department had put in efforts in recent times to move into new emerging areas such as Molecular Modelling, Bioinformatics, Molecular Imaging, Translational research in Cancer, Molecular Medicine Nano-biophysics, structural biology and Nuclear Medicine. Advances in these areas have paved a way for the designing and development of drugs and medical welfare of mankind. technologies for the It is the only department in India, which offers both undergraduate and postgraduate courses in the discipline of Biophysics (under the framework of Honours School System). The department also offers excellent research opportunities leading to the award of Ph.D. degree. The courses being offered in the three years B.Sc. Honours and two years M.Sc. Biophysics programme have been planned in such a way to provide a broad base in the subject and can be accepted in the diverse fields of biomedical sciences as well as life sciences. The department is also actively involved in collaborations with other departments of various Universities/Institutes for multidisciplinary research.

The strong base of the department has been built by its Veterans and nurtured by the current faculty. The department has a good number of publications to its credit which include research papers, review articles, books, national and international patents, and number of research projects

sponsored by national and international agencies. The faculty has also been bestowed with several renowned Academic and Research awards that simply convey the success story. World over, the alumni from this department have been well recognized and many of them occupy coveted positions in academia, industry, medical institutions and research institutions. In the last few years, around fifty alumni have been awarded international doctoral as well as post-doctoral fellowships.

The department has been selected by UGC for Special Assistance Program (SAP) DSA-Phase-I based for its accomplishments in research and education. Moreover, the Department of Science and Technology (DST), Government of India also has accorded it with the status of "DST-FIST Supported Department". The department has also received financial support in the form of PURSE grant. Currently, the department is also looking forward for a Public-Private Partnership Programme such as DBT-BIRAC, which supports research schemes to facilitate academia and industry collaboration.



SAIF/CIL

SAIF, formerly known as RSIC at Panjab University Chandigarh was incepted in the earlier years of the 6th plan. The complete facilities of USIC, CIL, SAIF and RSIC are working in unison in the service of research and also for imparting practical training to the students through workshops. CIL/RISC/USIC The Centre also undertakes the design, fabrication and repair of electronic instruments required by students and teachers from the University and the colleges around. It also runs training programmes in technical skills for the benefit of scientific community and associated different laboratory staff from institutions. The Centre houses the following Sophisticated Instruments: Transmission Electron Microscope (TEM) Hitachi (H-7500), Scanning Transmission Electron Microscope (SEM) Model JSM6100 (Jeol) with Image Analyser, Elemental Analyser for CHN (Thermo Scientific), FT-NMR Cryomagnet Spectrometer 400 MHz (Bruker), X-ray Diffractometer (Powder Method) . Panalytical.s X.Pert Pro, LC-MS Spectrometer Model Q-ToF Micro Waters, Liquid Nitrogen Plant Stirling (StirLIN-1), F.T.Infra-Red Spectrophotometer Model RZX(Perkin Elmer), UV-VIS-NIR Spectrophotometer Model Lambda 750 Perkin Elmer, WD-XRF Spectrometer Model-S8 TIGER Bruker.



HIGHLIGHTS OF THE PROGRAM

- The seven days STUTI training program will enables the candidates to go through all the major considerations while processing and assessing the histology of any tissue sample for disease diagnosis and prognosis.
- Candidates will be sensitized to the role of experimental animal models in mimicking various disease complications to deep dive in their mechanisms and possible therapeutic targets.
- Participants will get hands on experience with the experimental animals to get trained with various drug administration routes (oral, sub-cutaneous, intra-venous, and intraperitoneal).
- Participants will be familiarized with principle, application, sample processing and micrographs assessment on scanning and transmission electron microscopy techniques which help them to utilize this in their respective research interests.
- Apart from animal models, candidates will also be acquainted with the use of various cell lines (of different origin) to proceed with their preliminary research trials of any drugs or any other agent before going to animal models. This session will also encompasses basic cell culture techniques and mandates for cell culture.
- This training would be one of a kind wherein from *in vivo* to *in vitro* and then *in silico* techniques are clubbed so that participants could have a broad vision to see the channel from where he/she has to proceed with. Therefore, basic bioinformatics tools and their applications will be included in the training schedule.
- Furthermore, to get deeper insight into the possible targets in an *in vivo* or *in vitro* system, molecular biology based techniques would plausibly aid the purpose. Hence, real time PCR, RT-PCR, isolation of nucleic acids, gel electrophoresis is included in the schedule.
- Lastly, two major techniques (CD spectroscopy and NMR) for structure determination, purity assessment and many more applications is also included in the training program curriculum.

COMMITTEE

Patron

Prof. Raj Kumar

STUTI Program Coordinator, Panjab University

Prof. Ganga Ram Chaudhary

Chairperson, Dept. of Biophysics

Dr. Avneet Saini

Convenor, STUTI Training Program

Dr. Simran Preet

Organizing Members

Anshul

Jasleen

Nivedita

Shamli

Mayank

Panchali

Training Programme

Advanced Trends in Biomedical Sciences: Research and Skill Development

(Bioscience for human health mission)

under

Synergistic Training Program Utilizing the Scientific and Technological Infrastructure (STUTI)

Organised by

Department of Biophysics, Panjab University

in collaboration with

Sophisticated Analytical Instrumentation Facility (SAIF), Panjab University, Chandigarh

Time		Venue				
DAY 1 (1st August 2022)						
9:30- 11:00 A.M	Inaugural Function	Seminar Hall, Dept. of Biophysics				
11:00-11:15 A.M	High Tea	Dept. of Biophysics				
11:20 A.M-12:20 P.M	Lecture 1:- Introduction to analytical instrumenattion facility	Seminar Hall, Dept. of Biophysics				
12:20-1:30 P.M	Lecture 2:- Understanding Electron Microscopy	Seminar Hall, Dept. of Biophysics				
1:30-2:00 P.M	Lunch					
2:00-5:30 P.M	Hands On TEM/SEM (sample processing and visualization)	SAIF/CIL				
	DAY 2 (2nd August 2022)					
9:00-10:30 A.M	Lecture 3:- Animal models in Basic Research	Seminar Hall, Dept. of Biophysics				
10:30 A.M-1:00 P.M	Hands on Training on various routes of administration of xenobiotics in experimental animals	Cell Biology Lab, Dept. of Biophysics				
1:00-2:00 P.M	Lunch					
2:00-3:30 P.M	Lecture 4:- An insight into tissue histoarchiotecture and its relevance in disease detection and prognosis	Seminar Hall, Dept. of Biophysics				
3:30-5:30 P.M	Hands on Training tissue fixation, embedding, sectioning and slides preparation	Cell Biology Lab, Dept. of Biophysics				
	DAY 3 (3rd August 2022)					
9:00 A.M -10:30 A.M	Lecture 5:- Innovative technologies for biomass valorization and high value products development	Seminar Hall, Dept. of Biophysics				
10:30-12:00 P.M	Lecture 6:- "AMPs to ACPs": A therapeutic approach	Seminar Hall, Dept. of Biophysics				
12:00-1:30 P.M	Hands on basic cell culture mandates	Cell Culture Lab, Dept. of Biophysics				
1:30-2:00 P.M	Lunch					
2:00-5:30 P.M	Hands on training on various cell culture techniques	Cell Culture Lab, Dept. of Biophysics				

	Day 4 (4th August 2022)			
9:00-10:30 A.M	Lecture 7:- Digital Tools for scientific Research	Seminar Hall, Dept. of Biophysics		
10:30-12:00 P.M	Lecture 8:- Odyssey of Computational Biology: Intersection of biology and information			
	technology	Seminar Hall, Dept. of Biophysics		
12:00:1:00 P.M	Hands on various bioinformatics tools and softwares	Bioinformatics Lab, Dept. of Biophysics		
1:00-2:00 P.M	Lunch			
2:00-5:30 P.M	Hands on GROMACS	Bioinformatics Lab, Dept. of Biophysics		
	Day 5 (5th August 2022)			
0.00 10.15 4 14	Lecture 9:- Applications of plant genetic engineering and genome editing in crop			
9:00-10:15 A.M	improvement	Seminar Hall, Dept. of Biophysics		
10:15-11:30	Lecture 10:- Introduction to various molecular biology tools	Seminar Hall, Dept. of Biophysics		
11:30-1:00 P.M	Hands on training on isolation of nucleic acids from tissues	Biophysical Lab, Dept. of Biophysics		
1:00-2:00 P.M	Lunch			
2:00-5:30 P.M	Hands on training on gel elcetrophoresis, RT-PCR and real time PCR	Biophysical Lab, Dept. of Biophysics		
	Day 6 (6th August 2022)			
9:00-5:30 P.M	Visit to IMTECH, Chandigarh	IMTECH, Sector 39, Chandigarh		
	Day 7 (7th August 2022)			
0.00 10.20 4 14	Lecture 11:-Basics and applications of 1D and 2D Nuclear Magnetic Resonance			
9:00-10:30 A.M	Spectroscopy	Seminar Hall, Deptt of Biophysics		
10:45-12:00 P.M	Lecture 12:- Nanotechnology- Applications and Perspectives	Seminar Hall, Deptt of Biophysics		
12:00- 1:30 P.M	Hands on CD spectroscopy	Instrumentation Lab, Dept of Biophysics		
1:30-2:30 P.M	Lunch			
2:30-5:30 P.M	Valedictory	Seminar Hall, Deptt of Biophysics		

Training Program Outline

(1st August to 7th August)

Visit to SAIF

The objectives of the RSIC have been broadly identified as follows:

- 1. To carry out analysis of samples received from scientists working in universities, research institutions and industry.
- 2. To provide facilities to scientists to carry out measurements on sophisticated instruments not available in their own institutions.
- 3. Various types of advanced sophisticated instruments available in SAIF/CIL-
 - LC-Mass spectroscopy
 - GC-Mass spectroscopy
 - X-Ray Fluorescence
 - CHNO Analysis
 - FT-NMR 400/500 MHz
 - Small Angle X-Ray Scattering
 - X-Ray Diffractometer
 - Confocal Microscopy Imaging
 - FT-IR Spectrophotometer
 - Scanning Electron Microscopy
 - Transmission Electron Microscopy
 - Atomic Absorption Spectroscopy
 - Field Emission Scanning Electron Microscopy
 - High resolution Transmission electron microscopy
 - Inductively coupled Plasma-Mass Spectrometry
 - Microphotography
 - UV-Vis Spectrophotometer
 - Rheometer Analysis

Tissue Histopathology

Introduction

Surgical pathology includes gross and microscopic examination of resected specimens and biopsies by histopathologists for tissue diagnosis. Several steps are followed to get the tissue in a form, by which diagnosis can be made under light microscope.

Requirements

The laboratory should be large enough to accommodate various equipments and personnel to work with ease. The equipments which are kept in this laboratory are - Tissue processor, Tissue embedding table, Microtome, Tissue warming plate, Tissue flotation bath, Slide stainer or glassware for manual staining, Table to label and dispatch the slides.

Tissue Processing

Tissue processing: The aim of tissue processing is to embed the tissue in a solid medium firm enough to support the tissue and give it sufficient rigidity to enable thin sections to be cut, and yet soft enough not to damage the knife or tissue. Tissue processing stages involve: 1.1. Fixation: Fixation is the foundation for the subsequent stages in the preparation of tissue sections, up to the making of diagnosis. Most tissues are fixed before they are examined microscopically, therefore, it is essential that fixation is effective and that the appropriate fixative is used. The process of autolysis and bacterial attack should be prevented. Tissues should not change shape or volume and they should be left in a condition which subsequently allows clear staining of sections. At the same time, tissues should be as close to their living state as possible without loss or rearrangement. The choice of fixative for routine histology varies/differs for the different groups of chemical substances found in tissues. The most commonly used fixative in histopathology is 10% neutral buffered formalin. Bouin's fluid is used for fixing very delicate tissues, e.g. testis. The time required for correct, adequate and complete fixation varies from 6-48 hours depending on the size, type or nature of the tissue.

Dehydration: To remove fixative and water from the tissues and replacing them with dehydrating fluid. Clearing: Replacing the dehydrating fluid with a fluid that is totally miscible with both the dehydrating fluid and the embedding medium. Impregnation: Replacing the clearing agent with the embedding medium.

SAFETY :

- Caution when handling reagents
- Use disposable Nitrile gloves when handling carcinogens or toxic materials.
- Do not smoke, eat or d rink in areas where specimens or reagents are handled.
- Avoid contact of reagents with eyes and or mucous membranes. If contact with sensitive areas, wash with water.
- Patient's specimens should be handled as biohazard materials and disposed of with Precautions.
- Review the Safety Data Sheet (SDS) before handling reagents and solutions.
- Each open automated tissue processor is operated at least 5 feet from the storage of combustible materials and from the paraffin dispenser
- Replace all reagents every 2 weeks with fresh reagent.
- Check the solutions and paraffin level, if needed add it

TISSUE EMBEDDING TECHNIQUES

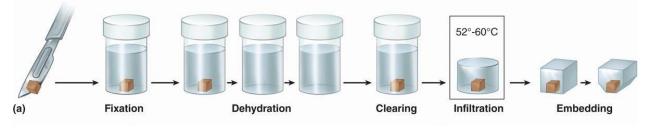
DEFINITION : Processed tissue specimens are embedded in molten paraffin wax the next morning using the tissue embedding machine.

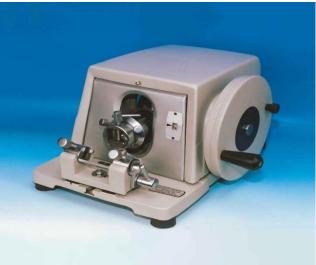
MICROTOME / SECTIONING:

DEFINITION : Embedded paraffin blocks are trimmed to expose the whole surface of the tissue using a microtome. After cooling the immersed surface, thin sections of 2-4 microns (um) are sectioned. (Some tissues for special stains e.g. Congo red stain may require thicker sections). Floated out in a water bath, picked unto a glass slide, labeled with the Pathology number of each specimen and allowed to drain and dry. After this, place the slide on a hot plate at about 45 °C to sufficiently melt off the paraffin and at the same time enable the section to adhere to the slide after which the slide is stained routinely for H&E or by special stains.

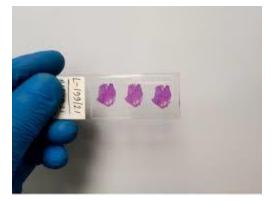
PRINCIPLE: Rotary microtomes, when maintained and used properly, are capable of cutting sections from paraffin blocks as thin as $1\mu m$. The rotary action of the handle (via the internal mechanism) causes the head of the microtome to which the paraffin block is secured, to advance by the number of microns set on the section thickness dial. As the block passes through the blade, a section will be produced according to this thickness setting. Once the sections are placed on a water bath, the expansion of wax due to surface tension and heat helps to remove wrinkles and

folds. In addition to a functioning microtome, sharp and blemish-free blades are essential for satisfactory cutting. Poorly prepared paraffin blocks may be sectioned with a good blade, but a poor blade may fail to cut even the best material.





Microtome for Tissue sectioning



FFPE Tissue Slide post H&E staining

Cell Culture

Cell culture refers to the removal of cells from an animal or plant and their subsequent growth in a favorable artificial environment. The cells may be removed from the tissue directly and disaggregated by enzymatic or mechanical means before cultivation, or they may be derived from a cell line or cell strain that has already been already established.

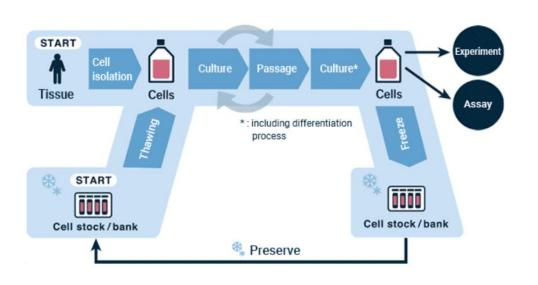
Primary Culture: Primary culture refers to the stage of the culture after the cells are isolated from the tissue and proliferated under the appropriate conditions until they occupy all of the available substrate (i.e., reach confluence). At this stage, the cells have to be subcultured (i.e., passaged) by transferring them to a new vessel with fresh growth medium to provide more room for continued growth.

Cell Line: After the first subculture, the primary culture becomes known as a cell line or subclone. Cell lines derived from primary cultures have a limited life span (i.e., they are finite; see below), and as they are passaged, cells with the highest growth capacity predominate, resulting in a degree of genotypic and phenotypic uniformity in the population.

Cell Strain: If a subpopulation of a cell line is positively selected from the culture by cloning or some other method, this cell line becomes a cell strain. A cell strain often acquires additional genetic changes subsequent to the initiation of the parent line.

Cryopreservation

If a surplus of cells are available from subculturing, they should be treated with the appropriate protective agent (e.g., DMSO or glycerol) and stored at temperatures below -130° C (cryopreservation) until they are needed.

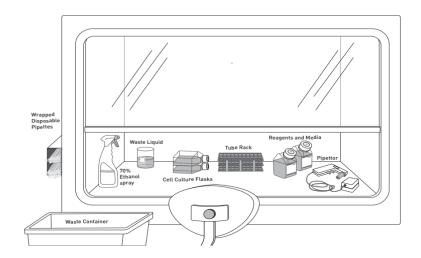


Preparation of Cells for Cell Culture

Cell Culture Equipment

The specific requirements of a cell culture laboratory depend mainly on the type of research conducted; for example, the needs of mammalian cell culture laboratory specializing in cancer research is quite different from that of an insect cell culture laboratory that focuses on protein expression. However, all cell culture laboratories have the common requirement of being free from pathogenic microorganisms (i.e., asepsis), and share some of the same basic equipment that is essential for culturing cells.

- Cell culture hood (i.e., laminar-flow hood or biosafety cabinet)
- Incubator (humid CO2 incubator recommended)
- Water bath
- Centrifuge
- Refrigerator and freezer (-20°C)
- Cell counter (e.g., Countess® Automated Cell Counter or hemacytometer)
- Inverted microscope
- Liquid nitrogen (N2) freezer or cryostorage container
- Sterilizer (i.e., autoclave)
- Aspiration pump (peristaltic or vacuum)
- pH meter
- Confocal microscope
- Flow cytometer



Basic Layout of Cell culture Hood

CD Spectroscopy

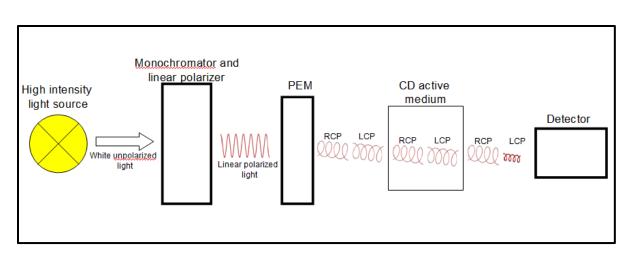
Introduction

Circular Dichroism (CD) is an absorption spectroscopy method based on the differential absorption of left (L-CPL) and right circularly polarized light(R-CPL). Optically active chiral molecules will preferentially absorb one direction of the circularly polarized light. The difference in absorption of the left and right circularly polarized light can be measured and quantified. UV-CD is used to determine aspects of protein secondary structure. Vibrational-CD, IR-CD, is used to study the structure of small organic molecules, proteins and DNA. UV/Vis CD investigates charge transfer transitions in metal-protein complexes.

Circular dichroism = $\Delta A(\lambda) = A(\lambda)LCPL - A(\lambda)RCPL$, where λ is the wavelength.

Instrumentation

Mostly CD instruments are based on the modulation techniques in which light is linearly polarized and passed through a monochromator. The single wavelength light is then passed through a modulating device, usually a photoelastic modulator (PEM), which transforms the linear light to circular polarized light. The incident light on the sample switches between LCP and RCP light. As the incident light switches direction of polarization the absorption changes and the difference in molar absorptivity can be calculated.



The instrumentation for a common CD spectrometer showing the polarization of light and the differential absorption of LCP and RCP light.

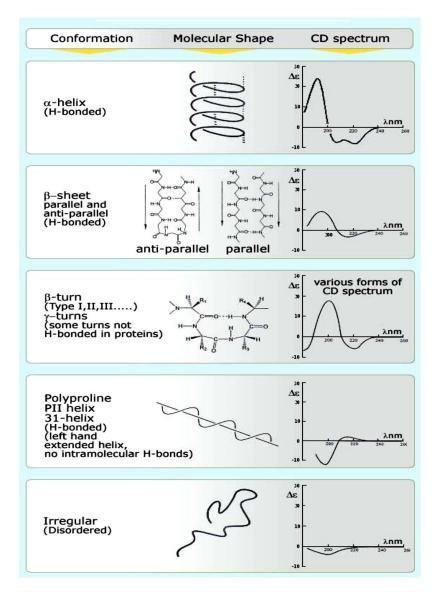
Sample Preparation

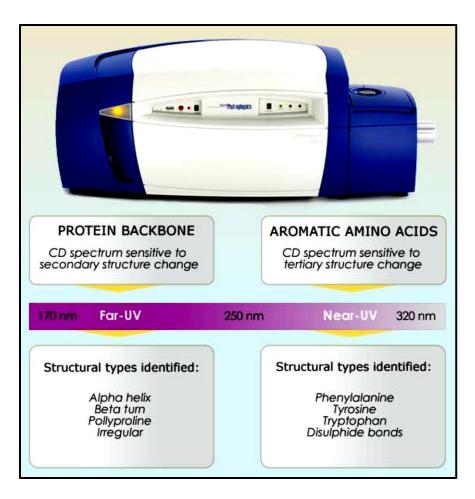
- Additives, buffers and stabilizing compounds: any compound which absorbs in the region of interest (250-190 nm) should be avoided.
- A buffer, detergent or other chemical compound should not be used unless it can be shown that the compound in question will not mask the protein signal.
- Protein solution: the protein solution should contain only those chemicals necessary to maintain protein stability, and at lowest concentrations possible. Avoid any chemical that is unnecessary for protein stability/ solubility. The protein itself should be as pure as possible, any additional protein or peptide will contribute to the CD signal.
- Contaminants: unfolded proteins, peptides, particulate matter (scattering particles), anything that adds significant noiseto the CD spectrum must be avoided. Filtering of the solutions may improve signal to noise ratio.
- Nitrogen Purging: the function of purging the CD instrument wit nitrogen is to remove oxygen from the lamp housing, monochromator and the sample chamber. The reason for removing oxygen id that oxygen absorbs deep UV-light, thus reducing the light available for the measurement.

Typical Conditions for CD

- Protein Concentration: 0.25 mg/ml
- Cell path length: 1 mm
- Volume: 400 µl
- Stabilizers (metal ions, etc.): minimum
- Buffer concentration: 5 mM or as low as possiblewhile maintaining protein stability.

Circular dichroism signatures of secondary structural elements





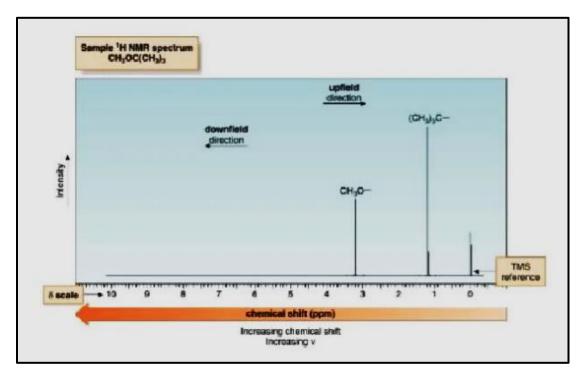
Nuclear magnetic Resonance (NMR)

Nuclear magnetic Resonance (NMR) is a powerful analytical technique used to characterize organic molecules by identifying carbon hydrogen frameworks within molecules. NMR is a branch of spectroscopy in which radio frequency waves (60-800 MHz) induce transition between magnetic energy levels of nuclei of a molecule. The Sample is subjected with two magnetic field one is stationary and another is varying at same radio frequency. The combination of these two field energy is absorbed by sample and signal is obtained. When electromagnetic field is provided to the nucleus of the sample, it starts spinning around its axis and generate another magnetic field. Combination of these two fields, the energy is absorbed by nucleus, this technique is called as NMR spectroscopy.

Types of NMR

1) 1 H NMR – it is used to determine the type and number of H atoms in a molecule. An NMR spectrum is a plot of the intensity of a peak against its chemical shift, measured in parts per million (ppm).

2) 13 C NMR- used to determine the carbon atoms in the molecule.



Principle

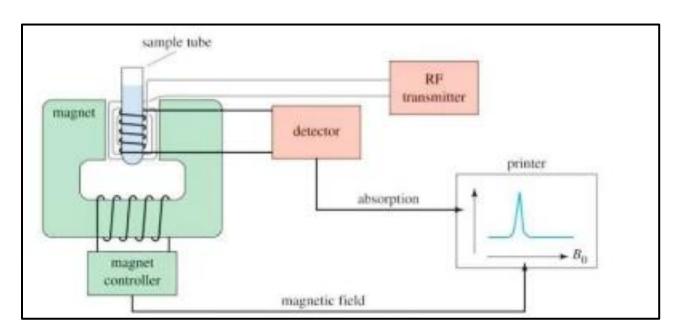
- The sample is dissolved in a solvent, usually CDCl₃ (deutero chloroform), and placed in a magnetic field.
- A radiofrequency generator then irradiates the sample with a short pulse of radiation, causing resonance.
- When the nuclei fall back to their lower energy state, the detector measures the energy released and a spectrum is recorded

- Protons in different environments absorb at slightly different frequencies, so they are distinguishable by NMR.
- The frequency at which a particular proton absorbs is determined by its electronic environment.
- Modern NMR spectrometers use a constant magnetic field strength, and then a narrow range of frequencies is applied to achieve the resonance of all protons.

NMR instrumentation

- 1) Sample holder
- 2) Permanent magnet
- 3) Probe
- 4) Sweep generator
- 5) Radio frequency transmitter
- 6) Radio frequency receiver
- 7) Read out systems





NMR instrumentation.

List of Candidates

Name	Qualification	Affiliation	State
Komal kumari	PhD	BHU, Varanasi	varanasi
gursimran kaur uppal	Assistant professor	Guru nanak khalsa college	bombay
Agrim Jhilta	PhD	INST,Mohali	mohali
Mandeep kumar	PhD	Gurujambeshwar university of science and technology	Hisar, haryana
Sandhya pal	PhD	Doctor B.R. Ambedkar centre for biomedical research	Delhi
Maya P shetty	PhD	Manipal college of health profession	Manipal, karnataka
Mahinder Pratap	PhD	CSIR, Institute of himalayan bioresource technology	palampur, H.P.
Shivanu Bharti	Post Doc	Jawaharlal university	Delhi
Shafali Bhasin	JRF-UGC	CSIR-IIIM	Jammu
Punam gaba	Assistant professor	ASBASJSMCOP, Bela	Ropar
Ravi kumar	DBT-SRF	INMAS-DRDO	Delhi
Richa gupta	Associate professor	ASBASJSMCOP, Bela	Ropar
Devindra kumar	Assistant professor	ASBASJSMCOP, Bela	Ropar
Tarsem	phd	MDU-Rohtak	Rohtak
rahul goyal	phd	IIT-ROORKEE	roorkee
jyoti yadav	Msc.	central university of rajasthan	ajmer
bhola prasad	Msc.	IIT-VARANASI	varanasi
pooja	phd	MD UNIVERSITY ROHTA	ROHTAK
jagphool chauhan	phd	maharishi dayanand university	rohtak
deepak	phd	MDU-Rohtak	rohtak
priya pradeep kumar	phd	delhi technological university	delhi
Rinkle	Phd	PGIMER	CHANDIGARH
Qsee H.S.	PhD	Manipal academy of higher education	Manipal, karnataka
Gaurav Mishra	PhD	BHU, Varanasi	varanasi
neithy sharma	PhD	School of Biotechnology, university of jammu	J&K
Priti khanduri	Assistant professor	Siddhartha institute of pharmacy	Dehradun
Yamini	PhD	National institute of malaria research	Delhi
Deepika	Project technical assistant	National institute of malaria research	Delhi
Neha raaina	PhD	Delhi pharmaceutical sciences and research university	Delhi
Ahamed tamanna manjur	PhD	BHU, Varanasi	varanasi
Garima	PhD	UIPS, PU	Chandigarh

CHARGES OF ANALYSIS

	Ch	ANGI				
400MHZ FT-NME	R SPECTROMETER			500MHZ FT-N	IMR SPECTROMETE	R
Facilities		P.U	P.U	Other Educational Inst.		Industry
1 D (1H NMR,13C NMR,	CDCL3/ D2O	200	320	400+18% GST	1200+18% GST	2000+18% GST
DEPT Experiment,	DMSO-d6	400	520	600+18% GST	1400+18% GST	2200+18% GST
NMR of any other Nucleus)						
(for each sample)						
2D (2DCOSY, NOESY,	CDCL3 / D2O DMSO-d6	400 600	640	800+18% GST	2400+18% GST	4000+18% GST
Experiments, HSQC, ROESY, TOCSY, HMBC Experiment,	DMSO-d6	600	840	1000+18% GST	2600+18% GST	4200+18% GST
Any other 2D experiment)						
(for each sample)						
	MALDI-TOF	SYNAP	T XS HD I	MASS SPECTROMETER		
Facilities		P.U	Other	Educational Inst.	R&D	Industry
Protein intact Mass by UPLC M		900		200 +18% GST	3600 +18% GST	6000 +18% GST
MALDI TOF/TOF- Protein ide for gel band and gel spots	ntification by MS/MS	750	10	000 +18% GST	3000 +18% GST	5000 +18% GST
Protein Profiling for complex m	uxture using 2D Nano-LC.	1350	1	800 +18% GST	5400 +18% GST	9000 +18% GST
(LC/MS/MS)	3					
Sequencing of Peptides using I		750	1	000 +18% GST	3000 +18% GST	5000 +18% GST
(for pure peptide only) (direct Molecular weight confirmation		750	14	000 +18% GST	3000 +18% GST	5000 +18% GST
Polymer analysis etc.	accurate mass determination	750		000 +18% GST	3000 +18% GST 3000 +18% GST	5000 +18% GST
Ion Mobility Study to separate a		450		00 +18% GST	1800 +18% GST	3800 +18% GST
compounds using Drift scope S	oftware	770		000 1 100/ 000	0000 - 100/ 000	1000 1 100 / COT
ETD compounds study.		750	10	000 +18% GST	3000 +18% GST	5000 +18% GST
	LIQUID CHRO	MATO	GRAPHY	MASS SPECTROMETRY		
Facilities	P.U			onal Inst.	R&D	Industry
MASS	480		8% GST		1800+18% GST	3000+18% GST
LCMS	800		18% GST	,	3000+18% GST	5000+18% GST
MS-MS HRMS	640 800		18% GST 18% GST	,	2400 + 18% GST 3000 + 18% GST	4000+18% GST 5000+18% GST
HRIVIS					3000+18% GS1	5000+18% GS1
				X-RAY FLUORESCENCE		
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Powder/ Solid Samples Liquid Samples	480/- 320		-18% GST 18% GST	L:	1800/- +18% GST 1200+18% GST	3000/- +18% GST 2000+18% GST
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EDX	240		8% GST		900+18% GST	1500+18% GST
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Facilities GCMS	P.U 800		-18% GST	ional Inst.	R&D 3000+18% GST	Industry 5000+18% GST
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CHNS	640		18% GST	ionai mst.	2400+18% GST	4000+18% GST
CHNS-O	1280		18% GST	,	4800+18% GST	8000+18% GST
	INDUCTIVELY COU	PLED PI	LASMA M	ASS SPECTROMETRY (ICP-	MS)	
Facilities	P.U			ional Inst.	R&D	Industry
Standardization	300	600 + 1	18% GST		1800 + 18% GST	3000 + 18% GST
Subsequent sample per element Sample Digestion	75		18% GST		300 + 18% GST	500 + 18% GST
	400 JID NITROGEN	500 + .	18% GST		1500 + 18% GST REOMETER	2500 + 18% GST
P.U Other Educational Inst				P.U Other Edu.		Industry
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	CTROPHOTOMETER			TRAINSIMIS	SION ELECTRON MI	GROSCOPE
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P.U Other Educational Inst				P.U Other Edu.	Inst. R&D	Industry
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	PHOTOGRAPHY			SCANNI	NG ELECTRON MICH	ROSCOPE
P.U Other Edu. Inst.	R&D Indu			P.U Other Edu.	Inst. R&D	Industry
15/shot 20/shot+18% GST	40/shot+18% GST 100/s	shot+18	3% GST	560 700+18% G		GST 3500+18% GST
τ	JV-VIS-NIR			LAB VISIT, SEMINA		
P.U Other Edu. Inst.	R&D Indus	-		Lab Visit Charges Worksh	op Charges Semi	nar Hall Booking - 3500/-
70 90+18% GST	270+18% GST 450+1	8% GS7	C	750 + 18% GST As per j	ob requirement for Pl	J & 3500 + 18% GST

