TATA MEMORIAL CENTRE

ADVANCED CENTRE FOR TREATMENT, RESEARCH AND EDUCATION IN CANCER

Open Day 2018

In 1995, the Cancer Research Institute (CRI) - then located at the Tata Memorial Centre's Parel, Mumbai campus, first organized an 'Open Day' to showcase its research programs before undergraduate and graduate students from science colleges of Mumbai. This tradition has continued uninterrupted and with the same vim and vigor even after CRI moved into the newly established Advanced Centre for Treatment, Research and Education in Cancer (ACTREC) in Kharghar, Navi Mumbai, in 2002. Both CRI and the Clinical Research Centre (CRC - established in 2005) participate enthusiastically in ACTREC's Open Day.

ACTREC is conducting its 16th Open Day on Thursday 6th and Friday 7th December 2018, when it will showcase some of its facilities to invited student groups and accompanying faculty from science, pharmacy, medical and allied colleges of Mumbai and Navi Mumbai. In four half day sessions, almost 500 students will visit the Centre. Each session will begin with a poster display on cancer research, diagnosis, treatment and prevention, followed by an introductory talk about ACTREC that will highlight the research, clinical and academic focus of the Centre. The lab visits - which are the highlights of Open Day, will then begin. Batches of 15 students and their teachers will be led by volunteers to the demonstrating labs. Each demonstration will highlight a technological platform used to further the group's research or clinical programs. The visitors will see cutting edge research and technology, and interact with scientists, clinicians, and research scholars.

Open Day 2018 Demonstrations

Cancer Research using Small Laboratory Animals	**Laboratory Animal Facility, ACTREC**
Comparative Oncology Program and Small Animal Imaging Facility	**Small Animal Imaging Facility, ACTREC**
Raman Spectroscopy for Cancer Diagnosis	**Chilakapati Lab, CRI, ACTREC**
Principles and practical aspects of Transmission Electron Microscopy	**Electron Microscopy, CRI, ACTREC**
Flow Cytometry	**Flow Cytometry Facility, CRI, ACTREC**
Protein Structure for Drug Discovery	**Macromolecular Crystallography & X-ray Diffraction Facility, CRI, ACTREC**
Composite Lab	**Composite Lab, CRC, ACTREC**
Radiation Oncology	**Department of Radiation Oncology, CRC, ACTREC**

Demo 1: Cancer Research using Small Laboratory Animals

Dr. Arvind Ingle, Officer-in-Charge, Laboratory Animal Facility, ACTREC
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ACTREC has Laboratory Animal Facility (LAF) to breed, maintain and supply quality rodents for its basic cancer research programs. Available animals encompass 10 basic strains of mice, 1 hybrid strain (B6D2F1) of mice, 14 transgenic mice, 9 knockout mice, and 23 crosses of Tg and knockout mice, one each Nude, SCID and NSG mice strains; 1 strain of rat; and 2 strains of hamsters, majority of which are inbred [http://www.actrec.gov.in/animal_main.htm]. Standard operating procedures are followed for all the activities of LAF, and stringent programs are in place for genetic monitoring, clinico-pathology, and assessment of microbiological status of laboratory rodents and animal feed. An embryo freezing program has been introduced for the animal strains maintained at ACTREC. LAF offers quality control services to outside facilities and provides surplus animal strains to the CPCSEA-registered animal facilities in India. The facility is an "Institutional Member" and recognized Training and Education Center of the International Council for Laboratory Animal Science (ICLAS). Since 2005, LAF has organized seven workshops and two certificate courses for laboratory animal professionals. It also accepts M.Sc./ M.V.Sc. students as dissertation trainees under its on-going quality control program. The LAF demonstration during Open Day 2018 will introduce some of the representative animal models maintained in the Laboratory Animal Facility of ACTREC, their characteristics, and usage for the biomedical/ cancer research. The demonstrators will also detail the numbering system, environment, food and water requirements, and housing enclosure conditions for different animal models.

Demo 2: Comparative Oncology Program and Small Animal Imaging Facility

Dr. Pradip Chaudhari, Scientific Officer G, CRI, ACTREC
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The focus of the facility is on preclinical animal imaging and research on radiopharmaceuticals. Diagnostic radionuclides such as technetium-99m and fluorine-18 complexes are being evaluated for their utility in imaging and for monitoring cancer xenografts in various mouse models. The facility is utilized for preclinical PET, SPECT and CT imaging involving rodents for basic and translational research projects of in-house scientists, other DAE units, academic institutes and pharmaceutical industries. The facility is designing imaging protocols, development of animal models, data quantitation and analysis. The facility also conduct imaging study for pharmaceutical industry. The preclinical imaging involves validation of liver and brain xenograft and orthotopic models using preclinical imaging modalities, PET and CT respectively. The animal oncology clinic (Kukkuripa) provides diagnosis and treatment of pet animals suffering from spontaneous cancer, and also examines comparative aspects of animal and human cancers. The animal cancer biorepository maintains biological specimens

such as blood, fresh-frozen or formalin-fixed or formalin fixed paraffin embedded tissues collected during diagnosis/ treatment, and uses it for comparative oncology research.

Demo 3: Raman Spectroscopy for Cancer Diagnosis

Dr. Murali Krishna Chilakapati, Principle Investigator, Cell & Molecular Imaging Group, CRI, ACTREC, E-mail: mchilakapati@actrec.gov.in

The discovery of inelastic scattering by Sir C.V. Raman in 1928 established a technique for elucidating the chemical constituents of complex samples as well as revealing the molecular structures of the same. The Raman Effect is a fundamental two-photon process in which energy is exchanged between light and matter, this exchange of energy is measured in the form of intensity measurement of inelastically scattered radiation. Combined with advantages such as low interference in signals from water and abundance of Raman active moieties, the technique is ideally suited, among optics based methods, for delineating complex biochemical changes characteristic of disease progression. We have assembled a fiberoptic Raman system for non-invasive (in vivo -on patients) and less invasive (body fluids like serum, urine and exfoliated cells) applications in oral and cervix cancers. We also have a commercial Raman microscope for Raman mapping measurements – single cell/tissue section maps. We would give brief background on Raman effect/spectroscopy and demonstrate both fiberoptic Raman and Raman microscope.

Demo 4: Principles and practical aspects of Transmission Electron Microscopy

Ms. Sharada Sawant, Officer-In-Charge, Electron Microscopy, CRI, ACTREC
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The Transmission Electron Microscopy Facility strives to provide high quality images with advanced techniques and equipments required for investigators to critically evaluate and interpret their data. The facility is open to in-house researchers, clinicians as well as external investigators and users. Transmission Electron Microscopy (TEM) facility at ACTREC promotes, supports and initiates research and training in the applications of TEM. The electron microscope is high resolution research-grade instrument that is used to study materials at the micro- and nano-structural level. At ACTREC the facility has JEOL JEM 1400Plus TEM. The microscope works at 80-120KV with 0.2nm resolution and magnification up to X12,00,000 which is suitable for biological, polymer, and material science applications. This system has been commissioned along with Energy Dispersive X-ray Spectroscopy (EDS) and Scanning Transmission Electron Microscopy (STEM). TEM can be used for life science studies which reveal the finest details of cellular structure. EDS helps in elemental characterization of materials. STEM allows high contrast imaging of biological samples without staining. The facility undertakes all the steps required for TEM sample preparation including araldite/epon block making (solid tissues, monolayer cell cultures, single cell suspension etc), semi-thin sectioning followed by ultrathin sectioning, grids scanning and imaging. Users are expected to get the fixed samples in the desired fixatives and their presence during grids scanning and imaging.

Demo 5: Flow Cytometry

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The Flow Cytometry Facility (FCM) is a centralized facility used by scientists/ clinicians from ACTREC for a wide range of research applications including immunophenotyping, multicolor analysis, DNA content and cell cycle analysis, apoptosis and proliferation studies, detection of mitochondrial membrane potential, stem cell analysis - side cell population, dermal stem cell analysis, detection of circulating tumor cells, functional assays like intracellular calcium influx, oxidative burst analysis, intracellular cytokine analysis, cytometric bead array assay for the detection of cytokines, and 4-way live cell and single cell sorting. The facility provides technical expertise in experiment design and data interpretation to researchers whenever required, and also provides training in data analysis. The facility has four flow cytometers: (a) FACSAria-I equipped with 3 lasers (407 nm, 488 nm, 633 nm), can perform 11-color analysis and 4 way-sorting, (b) FACSCalibur equipped with one laser (488 nm) and can perform 3-color analysis (c) FACSAria-III equipped with 5 lasers (407 nm, 488 nm, 633 nm, 561 nm and UV- 355 nm) which can perform 18 color analysis with 4 way sorting, and (d) Attune NxT equipped with 4 lasers (407 nm, 488 nm, 633 nm, 561 nm) and can perform 14 color analysis. The software used for data analysis include FACSDiva, CellQuest Pro, Attune NxT, FlowJo, FCAP Array and Modfit. The facility also offers its services to outside investigators on payment basis. Demonstrations and training were provided to staff and students on request.

Demo 6: Protein Structure for Drug Discovery

Dr. Ashok Varma, Principal Investigator and Officer-In-Charge, Macromolecular Crystallography & X-ray Diffraction Facility, CRI, ACTREC, Email: avarma@actrec.gov.in

X-ray Crystallography enables the scientist to determine precise position of each atoms and molecules present in crystallized materials. Macromolecular crystallization and X-Ray Diffraction facility has been installed and commissioned at ACTREC in 2012. This facility also has the remote access to synchrotron facility located

across the world. Facility helps scientists, research scholars in protein crystallization, structure determination and refinement. Different groups from ACTREC and nearby institutions collect the X-ray diffraction from the facility. The dedicated facility has (a) Crystallization unit, (b) Microscope to visualize the crystals, (c) Microstar -Microfocus Rotating Anode and (d) Integrated computer controller motorized Image Plate detector and (e) computers to process the data and determine the crystal structure of proteins. The ACTREC facility also provides hands-on training to different university/colleges faculty and assist them to understand the structure of biological molecules.

Demo 7: Composite Lab

Dr. Preeti Chavan, Office-In-Charge, Composite Lab, CRC, ACTREC
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Composite Laboratory is the central diagnostic laboratory of ACTREC-TMC and processes samples for routine hematology, clinical chemistry including immunoassay tests and emergency laboratory services.

For the demonstration purpose, we will be displaying the functioning of an equipment called OSMOMETER. It is an instrument capable of determining the osmolality of a solution by measuring an activity of that solution which is called a colligative property. It is a technique for measuring the concentration of solute particles that contribute to the osmotic pressure of a solution. The dissolved solutes increase osmotic pressure and boiling point of the solution and decrease vapour pressure and freezing point of the solution. A higher osmolality means certain particles are more concentrated while, lower osmolality means they're more diluted. A serum osmolality test is a way to check the fluid balance in the body. It helps a doctor differentiate and diagnose several possible conditions. The most commonly used method to determine the concentration of osmotically active compounds in diagnostic laboratories and also in our laboratory is freezing point technique. A depression in the freezing point of a solution of 0.00186 below that of water is equivalent to 1 milli osmol(mOsm) of osmotic activity per liter. Measuring serum osmolality is greatly useful in the management of disorders of hyponatremia which are associated with low sodium levels. It helps differentiate between various causes of hyponatremia and aides in the better management of the condition.

Demo 8: Radiation Oncology

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The department of Radiation Oncology at ACTREC provides high quality service, impart training and education, and conducts meaningful and ethical research in oncology in close collaboration with colleagues at TMH. The group also focusses on generating high-quality evidence for the use of advanced radiotherapy technology for various cancers including brain tumors, head & neck, breast, cervix, bladder, prostate cancers, and hematolymphoid malignancies. Ablative radiotherapy techniques such as Stereotactic Radiosurgery (SRS) and Stereotactic Body Radiotherapy (SBRT) are currently being evaluated in liver cancers, prostate cancers, and oligometastases. The department also performs Total Body Irradiation (TBI) as part of conditioning regimen for Bone Marrow Transplantation (BMT) and Total Skin Electron Therapy (TSET) for mycosis fungoides. Deep Inspiratory Breath Hold (DIBH) techniques for breast cancers and abdominal SBRT using video-feedback are also being practiced regularly for respiratory motion management.


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