



Tata Memorial Centre

Advanced Centre for Treatment, Research and Education in Cancer



ACTREC's OPEN DAY 2017

Thu. 7th and Fri. 8th December 2017

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 15th Open Day on Thursday 7th and Friday 8th December 2017, when it will showcase some of its facilities to invited student groups and accompanying faculty from science, 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 various aspects of cancer research, diagnosis, treatment and prevention, followed by an introductory lecture about ACTREC that will highlight the research, clinical and academic focus of the Centre. The lab visits - which are the highlight 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 and/or clinical programs. The visitors will get the opportunity to see cutting edge research and technology, and interact with scientists, clinicians, and research scholars.

Open Day 2017 Demonstrations	
1) Mass Spectrometry: Instrumentation and Applications	Mass Spectrometry Facility, CRI, ACTREC
2) Mass Spectrometry based Proteomic Approach to Identify Alternate Therapeutic Targets in Drug Resistant CML	Rukmini Lab, CRI, ACTREC
3) High Performance Liquid Chromatography	Clinical Pharmacology Lab, CRC, ACTREC
4) Next Generation Sequencing: an Overview	NGS Facility, CRI, ACTREC
5) Academics @ ACTREC	Students Council of ACTREC
6) Basic Equipments used in Biological Research	Common Instrument Room, CRI, ACTREC
7) Application of the Immunofluorescence Assay to Unravel Differentially Expressed Proteins in Human Oral Cancer Tissues	Waghmare Lab, CRI, ACTREC
8) Blood Banking: its Relevance in an Oncology Setup	Department of Transfusion Medicine, CRC, ACTREC

Demo 1: Mass Spectrometry: Instrumentation and Applications

Dr. Rukmini Govekar, Officer-in-Charge, Mass Spectrometry Facility, CRI, ACTREC

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The new generation mass spectrometers, coupled to high resolution liquid chromatography instruments, have enabled the identification and quantification of thousands of proteins in complex biological samples. The combination of analyzers with high sensitivity, resolution, mass accuracy with software and hardware interfaces that allow simultaneous detection of large number of proteins as also software tools that can handle the enormous data generated has revolutionized the field of 'Proteomics'.

The Mass Spectrometry facility at ACTREC houses two state-of-the-art mass spectrometry platforms connected to high performance liquid chromatographic and robotic systems:

- MALDI-TOF/TOF (Bruker Daltonics, Ultraflex II), a liquid chromatography system (Agilent 1200 series micro LC) and a spotter (Bruker Daltonics, Proteineer)
- Nano-LC (ABSCIEX, Eksigent) coupled to ESI-Q-TOF (ABSCIEX, Triple TOF 5600 plus).

These two mass spectrometry platforms are used extensively by scientists to profile tissues, sera and other biological fluids from patients with the aim to understand the molecular mechanism of the disease process, and to find biomarkers or therapeutic targets.

ACTREC's Open Day would provide an opportunity to the visiting students to see these instruments and understand their function.

Demo 2 Mass Spectrometry based Proteomic Approach to Identify Alternate Therapeutic Targets in Drug Resistant CML

Dr. Rukmini Govekar, Principal Investigator, Rukmini Lab, CRI, ACTREC

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Mass spectrometry based proteomics has proved to be the ideal approach to identify proteins associated with a disease process, which can be further exploited for their potential as markers or therapeutic targets. In our studies, we have used this approach to identify alternate therapeutic targets for cases of chronic myeloid leukemia (CML) resistant to the existing targeted therapy that uses tyrosine kinase inhibitors (TKIs) such as imatinib.

CML is associated with recurrent reciprocal chromosomal translocation between chromosome 9 and chromosome 22 [t9;22 (q34;q11)] with a resultant fusion gene BCR/ABL which encodes a constitutively active tyrosine kinase. Inhibition of kinase activity of Bcr/Abl with imatinib is the most successful therapy for CML. However, patients in advanced stages of CML - termed blast crisis (BC), are known to show resistance to treatment with imatinib. One of our research projects is aimed at identifying alternate or supplementary therapeutic targets for CML-BC using proteomic analysis of representative cell lines (viz. K562). To identify proteins that are differentially expressed in CML cells upon imatinib treatment, K562 cells with or without imatinib treatment were subjected to mass spectrometry based label-free quantitative proteomic analysis. Around 2500 proteins were identified of which 125 were found to be differentially expressed upon imatinib treatment. The differentiators were categorized based on their associated

functions using bioinformatics tools. Proteins that were associated with protein transcription and translation were found to be differentially expressed in cells treated with imatinib, wherein BCR/ABL activity was inhibited. The study has thus identified key components in the BCR/ABL pathway which can be further explored for their potential as therapeutic targets in cells wherein BCR/ABL is not inhibited by the present TKIs.

Demo 3 High Performance Liquid Chromatography

Dr. Vikram Gota, Officer-in-Charge, Clinical Pharmacology Lab, CRC, ACTREC

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The Clinical Pharmacology laboratory houses high performance liquid chromatography (HPLC) instruments hyphenated to different detectors namely diode array detector (DAD), fluorescence detector (FLD) and mass spectrometer (LC-MS/MS). The Dionex UPLC Ultimate 3000 (Thermo Scientific) and Nexera X₂ (Shimadzu) are powerful tools in bio-analytical sciences as they can qualify and quantify compounds that are present in any matrix, viz. blood, plasma, serum, urine and saliva. UPLC provides for two-fold detection of analytes based on retention time and absorbance in UV-visible range and/or fluorescence. Dionex UPLC 3000 gives accurate, precise and reliable results in small sample volume. The technique has a wide range of applications including bioequivalence studies, therapeutic drug monitoring (TDM) and pharmacokinetics studies.

During ACTREC Open Day 2017, we are going to demonstrate high performance liquid chromatography instrumentation and its applications.

Demo 4 Next Generation Sequencing: an Overview

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The field of DNA sequencing has witnessed rapid developments. The technology started from sequencing of meager short oligonucleotides and progressed to sequencing entire genomes, from use of hazardous chemicals and radioisotopes to real time analysis of sequences, and from taking years to sequence a genome to a few hours in obtaining entire DNA sequence.

The field of genetics, molecular genetics and molecular pathology of human diseases has been greatly benefited by the ability of various Next Gen sequencing (NGS) platforms to do rapid and cost effective massively parallel deep resequencing. It has led to numerous important discoveries, which would have otherwise been much more costly, tedious and perhaps impractical with the traditional Sanger sequencing.

Some of the advantages of NGS include:

- High throughput sequencing of the human genome which greatly facilitates new discoveries of genes and regulatory pathways associated with human traits and diseases.
- Targeted sequencing of specific genes or genomic regions helps in the identification of disease-causing mutations.
- RNA-Seq provides entire transcriptomic information of a sample without any need of previous knowledge related to genetic sequence of an organism.

NGS provides a platform where millions of DNA fragments are sequenced in parallel with much higher depth. From both research and clinical perspective, NGS has the potential to unfold genetic information, providing important leads in disease management at a much reduced cost.

Demo 5 Academics @ ACTREC

Students Council of ACTREC

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This year, on the occasion of ACTREC's Open Day, the Students Council of ACTREC (SCA) has taken the initiative to hold informal discussion with the visiting groups of young students from different colleges/universities, who may be interested in pursuing a career in research or academics. During this session, representatives of SCA will shed light on cancer research at ACTREC from a student's perspective. It will be an open discussion where we will brief them about different career options available after graduation/ post graduation and various competitive exams that will help them get entry into the Ph.D. program at ACTREC and other institutes across India. The session will cover the following aspects:

- Training program at ACTREC: Students will be informed how 6 weeks summer training in the College break during undergraduate studies or 3-6 months research training after graduation/ post graduation will help them decide whether a research career is suitable for them.
- Openings after graduation (B.Sc. / B.Tech.): Master's degree programs are offered by old, established universities like Mumbai, Pune, Hyderabad, etc. Students can appear for exams conducted by JNU and IIT-JAM (Biotechnology/ Biochemistry/ Life Sciences) or MSU Baroda (Biotechnology/ Medical Microbiology). Some institutes also have programs for Masters by research. Students who do not wish to continue in the Science field can leave academics at this point, and can opt either for MBA or service in the public/ private sector - based on their interest.
- Openings after post graduation (M.Sc. / M.Tech.): Students can opt to enter into the Ph.D program. We will provide them information about entrance examinations such as JGEEBILS, CSIR-UGC, DBT, ICMR, BARC-DAE (OCES/DGFS), TIFR, etc, as well as the exam pattern and further processes for getting enrolled into the Ph.D. program. Ph.D. options abroad will be discussed if there are specific queries. Students may alternately seek an academic opening as a lecturer. We will provide information about the NET/ SET exams for lecturership.

Important: There is no doubt that having a Ph.D. degree can make you more employable, boost your prospects, and help secure your future in the long term. But it is not a cakewalk. Your Ph.D. is a reflection of basic scientific aptitude, as also hard work of five plus years.

- Openings after Ph.D.: The session will briefly touch upon the post doctoral program in India/ abroad, along with openings in academia or R&D openings in Pharma and other industries.

At the end of this session, questions will be taken from visiting students and faculty.

Demo 6: Basic Equipments used in Biological Research

Mr. Uday Dandekar, Officer-in-Charge, Common Instruments Room, CRI, ACTREC

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Any research activity primarily involves the use of various basic but vital equipments for sample preparation and analyses. ACTREC maintains Common Instruments Rooms on different floors/ wings of the Centre to ensure optimal utilization of scientific instruments, making them available round the clock to the Centre's staff and students. Centrifuges and ultracentrifuges are basic tools for sample preparation, wherein the centrifugal force exerted on the sample in combination with the rotor leads to differential or density gradient separation. Spectrophotometer, Microplate reader and Nanodrop are equipments used for qualitative and quantitative analysis. They are based on Beer Lambert's law wherein the absorbance of light is measured. The Gel Doc system is used to digitize gel images. Ultrasonic cell disruptor is used for cell shearing. During Open Day 2017, these instruments will be demonstrated to the visiting students.

Demo 7: Application of the Immunofluorescence Assay to Unravel Differentially Expressed Proteins in Human Oral Cancer Tissues

Dr. Sanjeev Waghmare, Principal Investigator, Waghmare Lab, CRI, ACTREC

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Head and neck squamous cell carcinoma (HNSCC) ranks as the sixth most common type of cancer worldwide. In India, HNSCCs are the third most common cancers in males and females combined. However, most of the patients in India present at advanced stage with poor prognosis. Only 30-50% of the patients with locally advanced disease show 5 year survival, while 40-60% of them come up with locoregional recurrence or distant metastases.

Recently, cancer stem cells (CSCs), a rare subpopulation of cells within the tumour, have been shown to be responsible for metastasis and resistance to chemo-radio therapy. However, the mechanism of maintenance and regulation of these CSCs is not well understood. To understand the protein expression level of cancer stem cells in oral cancer tissues, immunofluorescence assay is one of the methods used to visualize a specific protein or antigen in the tissue sections. Also, it provides distinct information on the level of expression and location of the particular protein in the cells.

During Open Day 2017, we will demonstrate the detailed procedure of the immunofluorescence assay and the steps involved in tumour tissue collection, processing and preservation, which will be shown along with the histological images. The results of the assay already performed on oral cancer tissues using cancer

stem cells markers such as CD44, ALDH1 and Sox2 will also be shown. If time permits, we will also touch upon other antibody-mediated detection methods.

Demo 8: Blood Banking: its Relevance in an Oncology Setup

Dr. Shashank Ojha, Officer-in-Charge, Department of Transfusion Medicine, CRC, ACTREC
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The mission of the Department of Transfusion Medicine (DTM) is to provide safe and adequate supply of blood and blood components routinely, round the clock and for emergencies to cancer patients. Routine services provided include blood grouping, Rh typing, cross matching, direct/ indirect Coombs test, antibody titers, auto immune hemolytic anemia workup, immunohematology work up for medical oncology and bone marrow transplant (BMT) patients. Blood donation services of DTM encompass medical/ physical examination, donor counselling, outdoor blood donation camps, as well as routine/ therapeutic apheresis (plateletpheresis / leukapheresis). Laboratory services of DTM include well-equipped laboratories for red cell serology, component preparation, storage and issue, transfusion transmitted infections testing, flow cytometry, and quality control. Specialized blood products such as gamma-irradiated and leucocyte-depleted packed red blood cells, single donor platelets (SDPs), random donor platelets (RDPs), fresh frozen plasma (FFP), cryoprecipitates, and granulocyte concentrates are also provided to BMT patients.

Another focus is on hematopoietic stem cell banking which involves collection of peripheral blood stem cells (PBSC), assistance in bone marrow harvest, bone marrow processing on apheresis devices for red cell/ plasma depletion, hematopoietic stem cell CD34 and CD3 enumeration by flow cytometry, quality checks, cryopreservation, storage, issue and inventory maintenance. The department also plays a vital role in receiving cord, bone marrow harvest and peripheral blood stem cells (PBSC), assesses documentation, runs quality checks, and preserves/ issues them for unrelated stem cell transplant.

In a nutshell, DTM strives continually to maintain high quality standards in provision of safe blood and components, maintaining the principle of four R's (Right blood to Right patient in Right quantity for Right indication).

During Open Day 2017, the DTM demonstration will focus on apheresis procedures and also cover some of the vital component labs.

Map & Directions to ACTREC

