Research Core Facilities at Fondazione IRCCS Istituto Nazionale dei Tumori

The Fondazione IRCCS "Istituto Nazionale dei Tumori" of Milan (INT) is a comprehensive cancer center whose activities range from epidemiology (both descriptive and molecular) to rehabilitation and palliative care, through innovative prevention, diagnosis and treatment. INT is provided with 481 beds; in 2014, INT hospitalized a total of 19.597 inpatients (of which 5948 outpatients) and carried out a total of 1.201.563 consultations.
As an Institute for scientific research, treatment and care (Istituto di Ricovero e Cura a Carattere Scientifico, IRCCS), in accordance with its institutional mission, INT is in a privileged position to conduct translational research. To this end, multidisciplinary groups, including both basic scientists and clinicians, and also bioinformaticians and statisticians, work together to plan and perform major research projects concerning all type of cancer but adult Central Nervous System.
In 2014 INT has obtained the designation of "Comprehensive Cancer Centre" by the Organization of European Cancer Institutes (OECI), a qualification that INT shares with world-renowned European Institutions.
Educational activities are available for clinical and experimental researchers.

Research facilities

The following resources are available at the Department of Experimental Oncology and Molecular Medicine.

• ***Functional Genomics and Bioinformatics Core Facility***. The FGBCF performs: study design; RNA and DNA extraction and quality controls; labeling and hybridization methodologies required for high quality analysis; libraries' preparation and quantification; data processing and statistical analysis. The activities of the FGBCF are conducted using the following state-of-the-art equipment: QIAcube and QIASymphonySP for nucleic acid purification; Agilent Bioanalyzer and Tapestation, Nanodrop, Qubit for quantity and quality control of nucleic acids; iScan (Illumina), SurePrint (Agilent) and Gene Chip System 3000 (Affymetrix) platforms for microarray analysis of mRNA, miRNA and lncRNA expression, ChIP-on-chip, DNA methylation, CGH and CNV, SNPs ; Quantstudio 12K with OpenArray, Accufil and Automation Robot for quantitative real-time PCR. For NGS studies Personal Genome Machine, Ion S5XL, Ion Chef (Life Technologies) and Next Seq 500 (Illumina) with dedicated servers are available. Full computational analyses are performed using open-source software and dedicated licenses. Identification and bio-functional interpretation of promising biomarkers are based on differential expression analysis, pathway analysis (IPA, Qiagen) with over-representation or gene set enrichment approaches (GO and GSEA), and integration of different kinds of data. The samples manipulated by the FGBCF and all the experimental and bioinformatic activities are tracked using dedicated software provided by TwinHelix and IBM, respectively. The scientific and technical staff of the FGBCF has the appropriate background, knowledge and skill in the specific field of interest.

• ***Immunohistochemistry*****:** performs histological and cytological processing by a wide range of histological techniques, immunohistochemistry, in situ hybridization, and autoradiography.

• ***Cell imaging facility***: provides access to the BioRad Radiance 2000 and Leica SP8 AFC AOBS WLL HyD laser confocal microscopes allowing for a wide range of fluorescent dye use, sequential and simultaneous up to 8 channel bright field image collection, and live cell imaging.

• ***Flow cytometry and cell sorting***: using state-of-the-art flow cytometric instrumentation, and software analysis.

• ***Microbiology service*** for plasmid DNA purification; mutagenesis; bacterial strains transformation and storage.

• ***Laboratory animal facility.*** Animal facilities authorized by the Italian Ministry of Health for housing transgenic and immmunodeficient mice under standard pathogen-free conditions and, when needed, in isolators vented with sterile HEPA-filtered air.

• ***Tissue and cell repository***: Departments of Pathology and Experimental Oncology have implemented and maintain a large bank of frozen and FFPE normal, tumor tissues and blood/plasma/serum samples, collected and stored within a short time from removal following SOPs. Thousands of well-annotated clinical specimens of different tumor histotypes, linked to dedicated databases of patho-biological and clinical information, are currently available. Patients sign an informed consent which allows INT investigators to use the leftover material of biological samples collected during standard surgical and medical procedures for research purposes. Aliquots are attributed to individual studies after approval of Institutional Review Board and specific requests to the Ethical Committee. All leftover material is stored in the Institutional BioBank for at least 20 years from the collection, including residual material of specific project studies.

• ***DEParray platform*** combine imaging technologies with the ability to manipulate and recover individual, viable rare cells from a heterogeneous sample for subsequent culture or molecular analysis.

• ***Cytogenetics and molecular cytogenetics*** with state-of-the-art instruments, approaches of classic and molecular cytogenetics (fluorescent in situ hybridization and karyotype analysis using spectral karyotyping) and dedicated software allows identification of specific chromosomal alterations that are potentially useful for cancer diagnosis and as targets for novel treatments and/or associated with drug resistance in several solid tumor types.

• ***Proteomics/Mass Spectrometry Laboratories***
Maldi-TOF and Seldi-TOF instrumentation are available at DOSMM. LC Orbitrap is availalable at Department of Predictive and Preventive Medicine.

Other extensive and diverse facilities, are available for diagnostic and research purposes in the Units of Pathology, Radiology and Nuclear Medicine, Hemathology and Clinical Laboratory.
The Institute is equipped with cutting-edge equipment such as:

- 2 dual-head gamma-cameras (GE Infinia and Millennium MG) installed at the Nuclear Medicine Department;
- 1 6-slice SPECT-CT (Single Photon Emission Computed Tomography combined with Computed tomography) scan (SIEMENS Symbia Intevo 6) installed at the Nuclear Medicine Department;
- The PET unit is also equipped with various automated modules for synthesis of radiopharmaceuticals, 1 micro-PET for preclinical imaging and visualization of living animals for research purposes (GE Explorevista) and 2 PET-CT (Positron emission tomography combined with Computed tomography) whole body scanners (PHILIPS Gemini TF 64 slices and GE Discovery 710);
- 3 Computed Tomography (CT) scanners (PHILIPS 6-slice Brilliance installed at the radiotherapy department and PHILIPS 64-slice Brilliance and SIEMENS 128-slice Somatom Definition, both of them installed at Radiology Department);
- 3 1.5 Tesla Magnetic Resonance Imaging (MRI) scanners (SIEMENS Magnetom Avanto, PHILIPS Achieva and Ingenia, all of them installed at Radiology Department);
- The Radiotherapy Department is also equipped with 6 linear accelerators to deliver a wide range of cancer treatments (VARIAN DHX, Unique, DBX, Truebeam and Trilogy, ELEKTA Preciseplus);
- 2 automated robotic systems designed for the preparation of drugs (Health Robotics iv Station) installed at the Pharmacy Department.
- Personal Genome Machine and Ion S5XL (Life Technologies) are available for NGS at the Pathology Department.
- Ventana Benchmak Hybridization for automated in situ Hybridization
- Leica Laser Capture Microdissector, enabling users to isolate specific single cells or entire areas of tissue
- State-of-the-art flow cytometric instrumentation.

Research Infrastructures

Medical Statistics, Biometry and Bioinformatics
This division provides high quality statistics and quantitative support to clinical and translational research and also conducts independent methodological research and consulting, offering significant input into design, data collection and analysis in the areas of biostatistics, clinical epidemiology, basic, oriented and translational research.

Clinical Trials Center
The Clinical Trials Center supports Clinical Researchers in many aspects of investigational clinical studies, such as study design, statistical analysis/validation, data management, submission to Ethics Committees/regulatory authorities, budget and contract related issues, pharmacovigilance by dedicated personnel including data managers, statisticians, research nurses and administrative personnel. At present the CTC oversees and manages 364 clinical studies, 172 of which are investigator-initiated and 47 of them started in 2015.

Grant Office
The INT Grant Office provides timely advice and information to researchers on funding opportunities; coordinates the participation of the research projects to funding programs; provides information on the internal procedures for submissions of project proposals; supports researchers to the submission and the final financial report and audit processes.

Biomedical Library
The INT Library is affiliated to the European Association for Health Information and Libraries. It offers a large collection of basic science journals and reference books, and electronic access to the full text of scientific and clinical journals, databases and books.

Technology Tranfer Office
The INT Technology Transfer Office (TTO) was created in 2009 to address two requirements: improve research results in a scientific and economic key and optimize processes in technology transfer and intellectual property management. The TTO offers support services for patent activities (from the beginning of a new invention to the filing and maintenance of the correspondent patent), spin off evaluation and dissemination of IP culture within researchers.