Biocenter Finland

Supporting Frontier Research

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ABOUT BIOCENTER FINLAND

Biocenter Finland is a distributed nation-wide life science research infrastructure of the five Biocenters hosted by University of Eastern Finland, University of Helsinki, University of Oulu, University of Tampere, University of Turku and Åbo Akademi University. Over 300 principal investigators comprise the Biocenter Finland faculty at Biocenter Kuopio, Helsinki Institute of Life Science HiLIFE, Biocenter Oulu, Faculty of Medicine and Life Sciences (UTA) and BioCity Turku.

The mission of Biocenter Finland is to support frontier research in life sciences by providing state-of-theart open access technology services. These services are provided by the twelve technology platforms: Bioinformatics, Biological Imaging, Genome Editing, Genome-Wide Methods, Liquid Biopsies, Model Organisms, Proteomics and Metabolomics, Single-Cell Omics, Stem Cells, Structural Biology, Translational Technologies, and Viral Gene Transfer and Cell Therapy. Each is composed of nationally distributed nodes with complementary expertise. Biocenter Finland establishes, develops and coordinates the technology services and ensures resources for investments into the facilities from competitive sources, while the personnel costs are financed by the host universities.

The quality of research enabled by the Biocenter Finland technology services has reached global excellence and impact on society in several domains such as cancer, human genetics, immunology, neuroscience, personalized medicine and structural biology. Annually, more than 2000 research groups and non-academic teams from universities, research institutes and companies in Finland and abroad use the services of Biocenter Finland. In addition to the technology services, Biocenter Finland promotes research in life sciences by organising training workshops and events for the emerging generations of scientists.

The Academy of Finland – the Finnish Research Council positioned Biocenter Finland on the Finland's Strategy and Roadmap for Research Infrastructures 2014–2020 as a major national research infrastructure. Biocenter Finland works in close collaboration with the Finnish nodes of the Health and Food domain of the European Infrastructure Projects (ESFRI) that include the BBMRI, EATRIS, ELIXIR, EU-OPENSCREEN, EuroBioImaging, Infrafrontier and Instruct ESFRIs.



Marja Makarow Professor Director of Biocenter Finland

Annually, more than 2000 research groups and non-academic teams from universities, research institutes and companies in Finland and abroad use the services of Biocenter Finland.

The BF concept is to promote national collaboration, division of responsibilities, joint investments in state-of-the-art equipment, and provision of services on an open-access principle.

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TECHNOLOGY PLATFORM SERVICES

The Biocenter Finland services are produced by our Technology Platforms. The variety of services include training and access to instruments, support for planning experiments, and highly customised services with technically demanding technologies. In the following pages, the Technology Platforms are introduced shortly. See our web site biocenter.fi for more detailed description of the services and information how to access them.

		Member Institutes and Nodes				
Network	Technology Platform	в С К	B C O	B C T	Hi LI FE	M E D
Bioinformatics	Bioinformatics					
Biological imaging	Electron microscopy					
	Light microscopy					
	Small animal molecular imaging					
Genome editing	Finnish genome editing center					
Genome-wide methods	Genome-wide methods					
Liquid biopsies	Liquid biopsies					
Model organisms	FinGMice					
	Non-mammalian model organisms					
Proteomics & metabolomics	Proteomics-proteome					
	Metabolomics					
Single-cell omics	Single-cell omics					
Stem cells	Stem cells					
Instruct-Fl	Integrated structural cell biology					
	Protein service					
Translational technologies	Biobank technologies					
	Drug discovery and chemical biology					
Viral gene transfer & cell therapy	Viral gene transfer					

The Biocenter Finland technology platforms and local nodes at the member institutes. The dots indicate in which member institute the nodes are located: BCK, Biocenter Kuopio; BCO, Biocenter Oulu; BCT, BioCity Turku; HiLFE, Helsinki Institute of Life Science; MED, Faculty of Medicine and Life Sciences (UTA).

Bioinformatics

The task of bioinformatics is to provide tools, such as in silico modeling and simulation, to translate multidimensional biological data into knowledge and medical benefits.

The productivity of biomedical sciences and related industries is increasingly dependent on computational methodologies and software. Lack of such software or methodologies is seen as a bottleneck for cutting-edge research exploiting the high-quality Finnish biodata and novel measurement technologies.

Therefore, the major objective of the Bioinformatics infrastructure network and the corresponding technology platform is to provide services for both bioscientists and bioinformaticians.



Biological imaging – Electron microscopy

Electron Microscopy (EM) technology platform offers unique national services for 3D-EM at all length scales, phenotyping of gene-modified model organisms at the ultrastructural level, hybrid techniques with light microscopy, and correlative structure-composition analysis.

The consortium comprises three central electron microscopy core facilities located at Helsinki, Oulu and Kuopio. All units are accessible to any national or international users in biological and medical research. Each unit has clearly defined role, and have implemented common open-access policies and cost-recovery pricing across three universities.

Helsinki and Oulu units also belong to the Finnish Advanced Light Microscopy Node of the Euro-BioImaging research infrastructure. This multimodal service node focuses on four advanced technologies that are in high demand in Europe: super-resolution imaging, correlative light and electron microscopy, label free imaging, and mesoscopic imaging (www.eurobioimaging.fi).



Biological imaging – Light microscopy

The Finnish Light Microscopy (LM) Consortium provides open access to advanced imaging technologies and services. The Consortium has five light microscopy core facilities, located at five Biocenter universities. All units are accessible to any national or international users in biological and medical research.

The LM platform operates with nationally coordinated task division, where complementary state-of-theart technologies are featured at different sites, with integrated collaboration and unified policies on user access, quality control, and best practice. A common aim is also to facilitate data management, image processing and analysis, and software production.

The units of Helsinki, Turku and Oulu, also form the Finnish Advanced Light Microscopy Node of the Euro-Biolmaging research infrastructure. This multimodal service node focuses on four advanced technologies that are in high demand in Europe: super-resolution imaging, correlative light and electron microscopy, label free imaging, and mesoscopic imaging (www.eurobioimaging.fi).

Biological imaging – Preclinical in vivo SPECT/CT

The platform hosts a high-performance small animal SPECT/CT imaging for quantitative real-time tracking of tracers in 3D at high resolution, suitable for preclinical research in drug development, neuroscience, oncology, cardiovascular system and others.

We are able to perform drug delivery and biodistribution studies of drug molecules, both biologic and chemical compounds. Pharmacodynamics studies include imaging of drug-target interactions and imaging of drug effects in degenerative brain and heart diseases and visualization of anticancer effects among others.

We provide services for industry and academia offering integral services in liaison with the Radiopharmaceutical chemistry laboratory, which provides expert services in synthesis of imaging tracers and biological evaluation by radiotracer methods (e.g. in autoradiography).

Genome editing

Finnish genome editing center (FinGEEC) is a new infrastructure initiative to facilitate capture and development of novel genome editing technologies to generate knockout and sequence- specific gene expression control systems in cell lines, patient-derived cells and tissue models, and in ES cells/fertilized oocytes for rapid generation of genetically engineered rodents.

FinGEEC is a timely initiative following current trend to move from unstable RNAi-based approaches to more stable genome editing. FinGEEC will integrate, provide support and spread the use of genome editing activities across Finnish biocenters. FinGEEC captures the latest genome editing technologies and via establishment of better infrastructures and services lowers the bar for research groups to access new disruptive technology in genetic analysis.

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Genome-wide methods

Genome-wide methods network provides state-of-theart genomics services by utilizing the latest sequencing platforms, develops and implements novel methods, and coordinates the services nationally.

Sequencing and array based services are available for genomics and for gene expression and regulation applications, including resequencing, de novo sequencing, metagenomics, sequencing of custom targets, GWAS and targeted SNP genotyping, copy number analysis, CHiPseq, DNA methylation analysis, RNA and miRNA -seq, gene expression microarrays, and qPCR.

The services are available on Illumina, Pacific Biosciences, Fluidigm, Agilent and Nanostrings platforms. Network also provides genome-scale reagents (ORF, SiRNA, shRNA) and related services for BF researchers.



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Liquid biopsies

The introduction of personalized treatment of cancer leads to urgent needs for molecular characterization of cancer cells to target disease progression and to monitor therapeutic response. Liquid biopsy platform is new emerging service provided. The platform develops technologies for non-invasive analysis of malignant cells or tumor-derived nucleotide acids shed in blood, urine or other bodily fluids. The analysis can be based on tumor cell-free DNA (cfDNA), isolated exosomes, circulating tumor cells (CTCs) or disseminated tumor cells (DTCs). At the moment, prostate cancer CTC detections based on qRT-PCR and sequencing of AR aberrations from cfDNA are available. The computational tools to analyze cfDNA are also available in the Bioinformatic platform.







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Model organisms - FinGMice

Genetically modified (GM) mice have become key organisms to understand the molecular basis of health and disease in man and to serve as suitable animal models for human disease.

FinGMice integrates core facilities and service units involved in generation and analysis of GM mice within Finnish universities. The aim is to enhance dissemination of knowledge in the field and to combine expertise available in Finland and strengthen the competitiveness of Finnish biomedical research.

Via FinGMice we provide information about services and expertise in generation and analysis of GM mice available in Finland. The Oulu unit serves also as the Finnish node of the European Mouse Mutant Archive (EMMA), part of INFRAFRONTIER, the European Research Infrastructure for the generation, phenotyping, archiving and distribution of model mammalian genomes, www.infrafrontier.eu.

Model organisms – Non-mammalian models

Based on conservation in cell physiology during evolution it is possible to use genetically tractable non-mammalian model organisms such as the fruit fly (*Drosophila melanogaster*) and zebrafish (*Danio rerio*) to study questions in life sciences. *Drosophila* is one of the most traditional genetic model organisms while the use of the zebrafish model has been growing steadily during the past decade.

Provided services include maintenance of the desired zebrafish and fly lines, hands-on guidance to create transgenic or mutant lines and annual training courses, for instance. Recently established or upgraded state-of-the art facilities are located in Helsinki and Tampere.





Proteomics & metabolomics – Protein-proteome network

The protein-proteome network (PPN) provides access to high-quality services in proteomics and protein characterization. All major universities in Finland are part of the network. The services provided include proteomics, glycoproteomics, protein arrays, protein quantification, MS imaging, PTM analyses, characterization of protein interactions, membrane protein analysis, organelle proteomics, spectroscopic techniques and biophysical characterization of proteins.

The services are organized by highly skilled personnel, which also contribute to the data analysis. Training for the use of the services and instrumentation are provided and the network organizes teaching for students and researchers. We are experiencing that the quantitative proteome-wide analysis methods are gaining priority and thus our network has important role in method adaptation and development – all of which requires sophisticated instrumentation as well as trained experts.

Proteomics & metabolomics – Metabolomics

The Biocentre Finland Metabolomics Platform comprises of FIMM, ViMU, and BCK Units, and offer complementary analytical services. FIMM Unit offers high-throughput untargeted and targeted metabolomics and lipidomics analyses in various biological and clinical samples with biostatistical analyses as an option; and customised metabolic flux analyses using tracer studies.

ViMU Unit offers plant metabolomics and metabolomic profiling; targeted and non-targeted analysis of microbial metabolites, analysis of drug metabolites and other synthesis products. BCK Unit focuses on LC-MS based metabolomics analysis with non-targeted metabolite profiling, as well as targeted, quantitative approaches for various sample types including biofluids, tissues and in vitro material.

Single-cell -omics

Single Cell -omics platform aims at bringing the latest single cell omics tools available for the research community. Services based on novel instruments are now available for single cell genomics and single cell proteomics to enable cutting-edge research in many areas of molecular biology and molecular medicine.

For single cell genomics Chromium[™] instrument by 10X Genomics and InDrop[™] and DropSeq[™] systems enable thousands of individual cells to be transcriptionally profiled. Fluidigm Polaris[™] system enables to select targeted single cells and hold them in environmentally controlled reaction chambers enabling perturbations with RNAseq readout.

For single cell proteomics we will provide services on Helios[™] mass cytometry, which can differentiate up to 100 epitopes and obtain high content multiplexed protein data from singlecells. This enables the comprehensive understanding of cell phenotypes and function. ■







The efforts of the network are directed to obtain knowledge and protocols to generate and apply induced pluripotent stem cells (iPSC) for various biomedical research purposes. Patient iPSC permit for the first-time detailed studies on the molecular mechanisms of human genetic disease, drug screening and the development of novel therapeutics in clinically relevant models.

In the long term, the iPSC should provide new possibilities for regenerative medicine. The main services provided by the platform are related with the generation of iPSC lines, their genetic modifications, and the development of efficient methods for their differentiation into various cell and tissue types.





Instruct-FI – Integrated structural cell biology in Finland

Structural biology and biophysics covers a wide range of topics, from high quality sample production to structure determination and biocomputational analysis.

Instruct-FI is a national integrated structural cell biology research infrastructure that supports state-of-theart research in protein and biomolecular complex production, purification and characterization; cryoelectron microscopy; nuclear magnetic resonance; native mass spectrometry; structural bioinformatics; and X-ray crystallography.

Instruct-FI activities are distributed in six universities (Helsinki, Oulu, Turku, Åbo Academi, Eastern Finland, Tampere), and the units are well-established as scientifically-driven core facilities with wide industrial and academic, international and domestic user networks. Instruct-FI is included on the Finnish Research Infrastructure 2014-2020 roadmap.





Instruct-FI – Protein services

The Protein production is part of structural biology Instruct-FI network and offers protein expression in four different systems: bacterial, insect, mammalian cells and in-vitro translation. These systems supply the expression and modification requirements for a comprehensive variety of proteins.

Protein expression steps can be optimized for the greatest yields. Purification is performed with affinity tag(s) and fusion additives of choice that can also be used for protein characterization. The facility is able to scale up expression and purification systems to obtain protein yields of several hundreds of milligrams.



The main goal of the technology platform is to support incorporation of digital microscopy in medical projects related to biobanks, tissue analytics and studies of celland tissue biomarkers.

High-resolution, high-throughput microscopy scanners are available for digitization of histological and cytological samples. Both brightfield and fluorescent scanning can be performed and scanned whole-slide images can be delivered through online cloud-based microscopy platforms or on disk.

The consortium also provides know-how regarding phenotypic characterization of tissue samples and for automated computer-vision analysis. The platform has been improved further to enable seamless integration of whole-slide images with biobank samples, clinical databases and computational environments for artificial intelligence-supported analysis.

Translational technologies – Drug discovery and chemical biology

The DDCB platform focuses on drug discovery and development, and is linked to the European EATRIS and EU-Openscreen infrastructures, coordinated in Finland by FIMM. This platform will further develop several existing strong capabilities in Finland, such as chemoinformatics/ structural biology, high-throughput screening, as well as in vivo testing.

The aim is to facilitate the capabilities for discovering inhibitors to interesting targets, and to carry out proof-of-concept testing in vivo. This platform should optimally bridge the gap between academic research and industrial interests to drug discovery.





Viral gene transfer & cell therapy

Biocenter Finland Viral Gene Transfer and Cell Therapy Network (VGTCT) was established to guarantee that scientific community and biotech industry in Finland has access to the highest quality viral gene transfer vectors which are produced in a standardized manner with validated techniques at affordable prices.

VGTCT has been an excellent example of Biocenter Finland networks providing established vector services to a high number of domestic and international researchers and biotech companies. In addition to the production of high quality vectors, the mission of VGTCT network is to promote the use of viral gene transfer methods in Finland and to support development of novel gene delivery vectors and applications.

VGTCT is a joint, unified consortium of all Finnish Biocenters strengthening collaboration and building specific profiles of Finnish Biocenters.

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BF Biocenter Finland

Coordination office www.biocenter.fi/contact

Postal address P.O. Box 63 FI-00014 University of Helsinki Finland

Street address Biomedicum Helsinki I Haartmaninkatu 8 FI-00290 Helsinki Finland

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