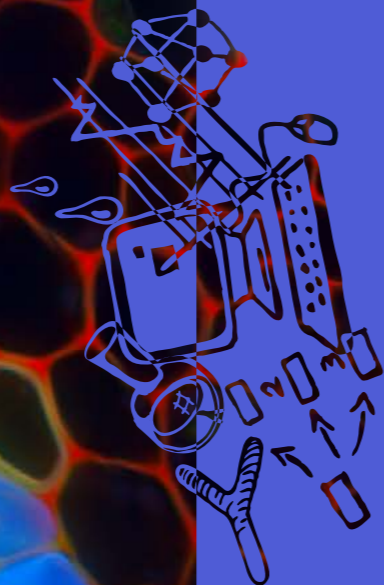


Faculté de biologie et de médecine

CORE
RESEARCH
FACILITIES



RESEARCH INFRASTRUCTURES (UNIL-CHUV)

The Faculty of Biology and Medicine (FBM) at the University of Lausanne (UNIL) operates 12 state-of-the-art facilities that are continuously pushing the boundaries of knowledge in biomedical science by encouraging fundamental, translational and clinical research from the nano to the macro scale.

Our facilities provide cross-disciplinary support to researchers both at UNIL, at the University Hospital CHUV and beyond in fields including structural biology, imaging, genomics, proteomics, metabolomics, cytofluorometry, histology, bioinformatics and biostatistics, through a combination of powerful data analysis and unique skills assisting the researchers from the design optimization to the project execution. Staff at our facilities also train users on the different kinds of technology available, through both theoretical instructions and hands-on practice.

At FBM, we regularly incorporate emerging technologies into our platform portfolio, constantly investing into new equipments, IT systems and personnel to help researchers making transformative discoveries. We are willing to establish new facilities in response to the rapid scientific advances and the needs of the researchers.

Prof. Claudia Bagni
Vice Dean of Research and Innovation

Science editor: **Dr. Anne-Christine Butty**

Graphics: **Communication FBM**, with contributions from the facilities

LIST

[Cellular Imaging Facility](#) ^{CIF}

[Electron Microscopy Facility](#) ^{EMF}

[Dubochet Center for Imaging](#)* ^{DCI}

[Flow Cytometry Facility](#) ^{FCF}

[In Vivo Imaging Facility](#) ^{IVIF}

[Cardiovascular Assessment Facility](#) ^{CAF}

[Histology Facility](#) ^{HF}

[Protein Analysis Facility](#) ^{PAF}

[Metabolomics & Lipidomics Facility](#) ^{MLF}

[Bioinformatics Competence Center](#) ^{BDC}

[Biostatistics Facility](#) ^{BSF}

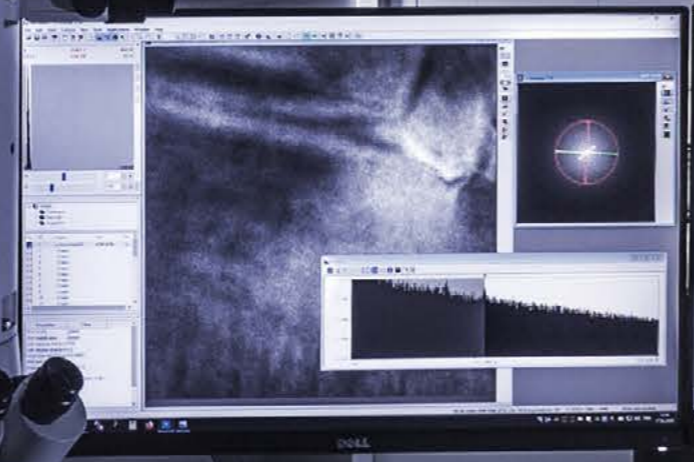
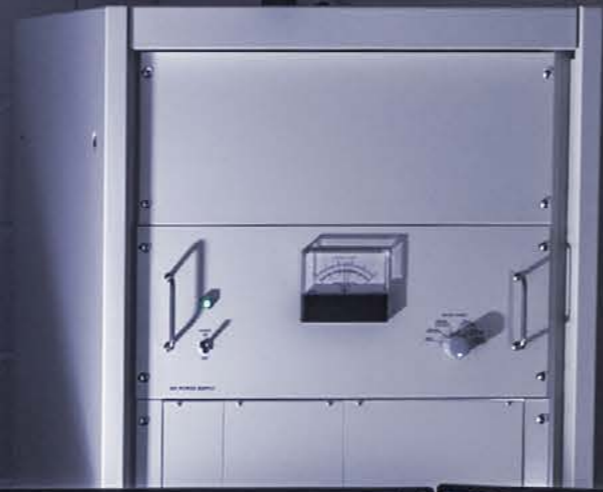
[Genomic Technologies Facility](#) ^{GTF}

[Clinical Research Center](#) ^{CRC}

[Location map](#)

*The DCI is a simple partnership under the authority of the UNIL rectorate and not of the FBM. Therefore, the DCI is not a faculty platform of the FBM and is in no way bound by agreements concluded between UNIL and external partners regarding the access to or running of the faculty platforms/facilities of the FBM.

Plus Electron Microscope



IMAGING



CELLULAR IMAGING FACILITY ^{CIF}

The Cellular Imaging Facility (CIF) provides a wide range of optical microscopy services along with training (through courses, workshops and video tutorials) and consulting on topics such as using the latest open-access systems and developing tailor-made data acquisition and analysis protocols. Facility staff are available to support scientists in their research. The CIF is spread across four sites – Agora, Bugnon, Dorigny and Epalinges – each possessing a variety of imaging instruments for both general and specific research needs. In response to growing demand for remote access, the facility has set up powerful data processing and analysis workstations that can be used remotely for tasks like deconvolution and 3D reconstruction and for running common imaging software.

The CIF is intended for use by researchers at FBM, other UNIL faculties and outside entities (including companies, based on specific agreements).

Primary research equipment

Confocal microscopy

Spinning disk and time-lapse microscopy

Widefield fluorescence and bright field microscopy

Stereomicroscopy and macroscopy

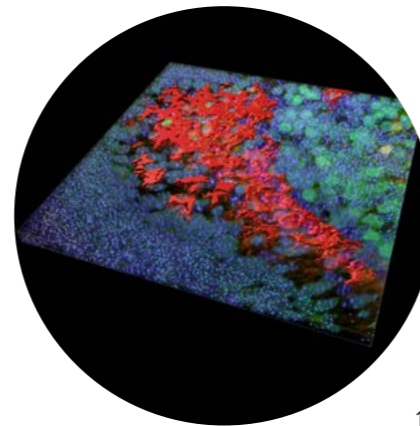
Slide scanning

Multiphoton confocal and enhanced resolution microscopy

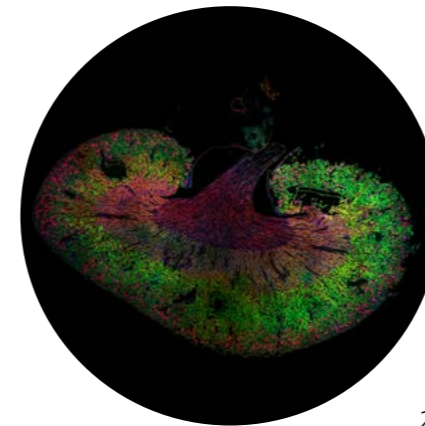
Laser-capture microdissection

Light sheet microscopy

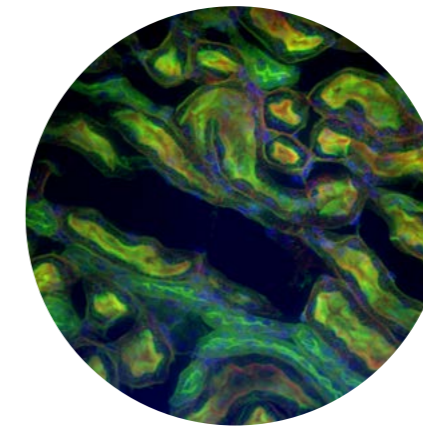
A full list of the equipment available at the CIF is given on its webpage.



1.



2.



3.

Main image: Convallaria root autofluorescence observed with a Leica DMI8 widefield microscope

1. 3D reconstruction of neuronal cells acquired with a Leica Stellaris 8 confocal microscope with Imaris

2. Whole mouse kidney section triple fluorescent staining acquired with a Zeiss Axioscan Z1 slide scanner

3. Close-up on kidney glomeruli acquired with a Nikon spinning disk microscope and deconvolved with SVI Huygens

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ELECTRON MICROSCOPY FACILITY ^{EMF}

The Electron Microscopy Facility (EMF) provides training and other services, including the use of its advanced electron microscopes, to life-science researchers. Its staff are specialized in sample preparation for imaging and in image analysis, and can support researchers with all aspects of cellular electron microscopy: negative staining, 2D TEM, TEM tomography, array tomography and FIBSEM. The EMF works closely with EPFL's Biological Electron Microscopy Facility so as to offer a broader range of services. It also supplies skills and research instruments to the Dubochet Center for Imaging to conduct cryo-tomography sample preparation.

The EMF is intended for use by researchers at FBM, other UNIL faculties and outside entities (including companies, based on specific agreements).

Primary research equipment

Aquilos 2 cryo-focused ion beam scanning electron microscope with lift-out and CLEM module Thermo Fisher Scientific

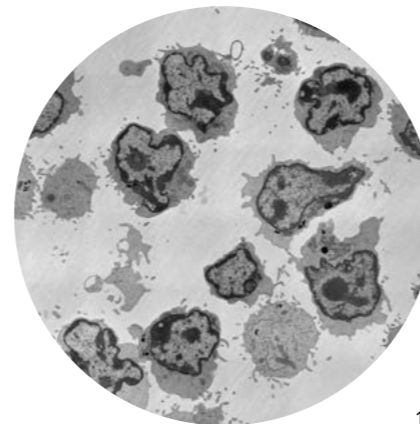
Leica cryo-thunder light microscope

Focused ion-beam scanning electron microscope for volume-SEM

Thermo Fisher Scientific 120 kV screening transmission electron microscope

Leica ICE-EM high pressure freezer

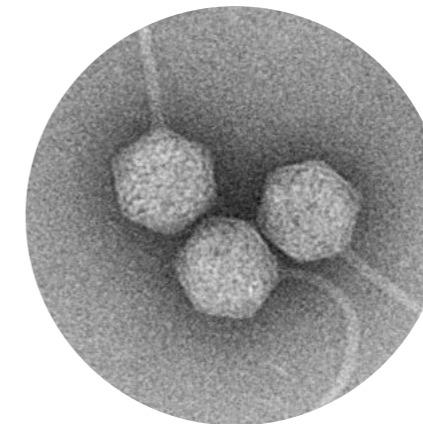
A full list of the equipment available at the EMF is given on its webpage.



1.



2.



3.

Main image: Zebrafish muscle, slow fibers - TEM

1. T lymphocytes - TEM

2. Tick - SEM

3. Bacteriophages - TEM

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DUBOCHET CENTER FOR IMAGING^{DCI}

The Dubochet Center for Imaging (DCI), managed jointly by UNIL, École polytechnique fédérale de Lausanne (EPFL) and the University of Geneva (UNIGE), is highly specialized in cryo-electron microscopy. It is named after Prof. Jacques Dubochet, who was awarded the 2017 Nobel Prize in Chemistry for his pioneering work in cryo-EM technology. The DCI aims to firmly establish the Lake Geneva region as a center of excellence in bioimaging research.

The sophisticated technology available at the DCI lets researchers address questions related to single particle analysis, visualize structures at the atomic level and use cryo-electron tomography to observe single molecules in their cellular context.

The DCI provides support to biomedical researchers by offering state-of-the-art equipment along with the expertise of a specialized team to perform the entire structural analysis pipeline. In addition, the DCI's experts work to strengthen bridges with methods such as light microscopy and FIB-SEM, and to extend cryo-EM to smaller and more flexible particles.

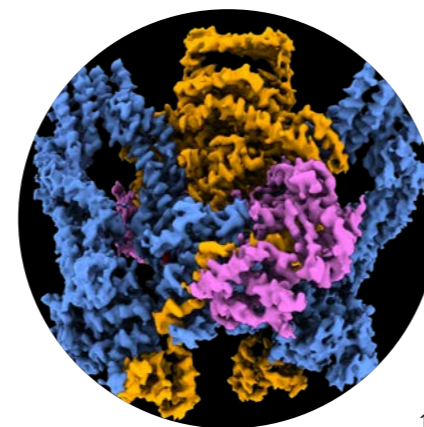
The DCI is intended for use by researchers at UNIL, EPFL, UNIGE and outside entities (including companies, based on specific agreements).

The DCI is a simple partnership under the authority of the UNIL rectorate and not of the FBM. Therefore, the DCI is not a faculty platform of the FBM and is in no way bound by agreements concluded between UNIL and external partners regarding the access to or running of the faculty platforms/facilities of the FBM.

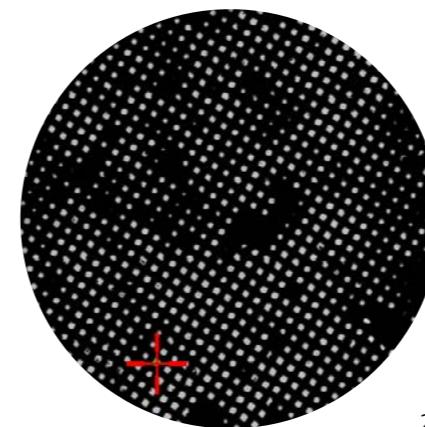
Primary research equipment

| |
|--|
| Titan 1 – 300kV Titan Krios G4, E-CFEG, SelectrisX energy filter, Falcon IV detector |
| Titan 2 – 300kV Titan Krios G4, E-CFEG, Falcon IV detector |
| Glacios 1 – 200kV Glacios, X-FEG, Falcon IV detector |
| Chameleon, Vitrobot, Leica GP2 (sample preparation) |

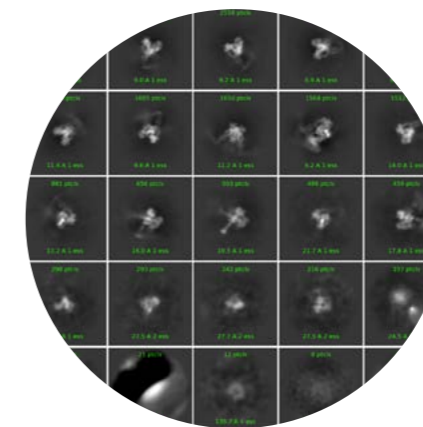
A full list of the equipment available at the DCI is given on its webpage.



1.



2.



3.

Main image: Titan Krios

1. Final 3D reconstruction of a Cryo-EM structure of DNA-bound structural maintenance of chromosomes (SMC) complexes, proteins are color-coded and DNA is in yellow
2. Cryo-EM grid displaying frozen samples
3. 2D classification for quality control



Address

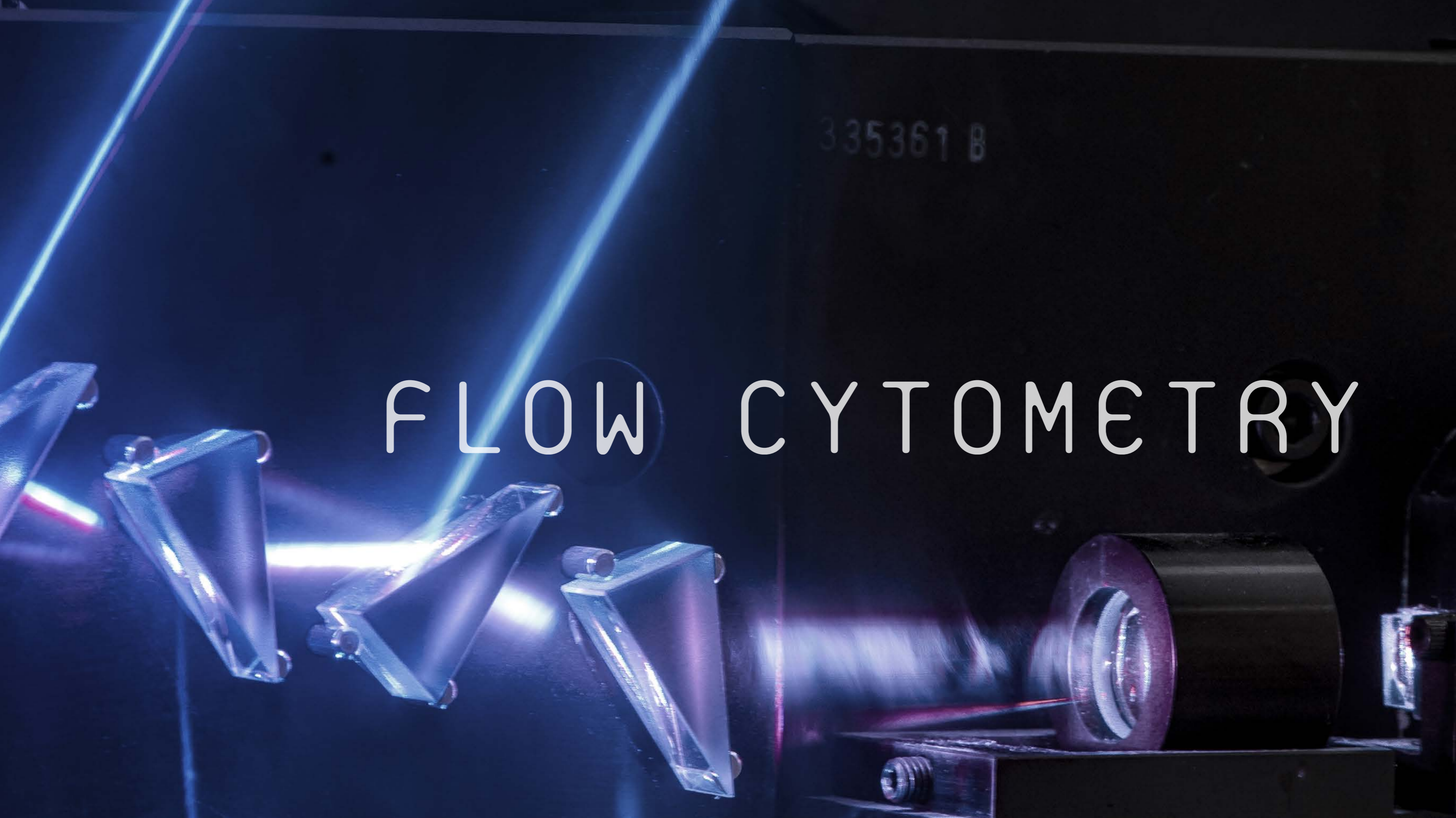
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335361 B

FLOW CYTOMETRY



FLOW CYTOMETRY FACILITY ^{FCF}

The Flow Cytometry Facility (FCF) provides state-of-the-art cell sorting services along with an array of multi-color analyzers. Its staff train researchers on flow cytometry methods, giving practical advice and explaining the theory behind staining panels, reagents and analysis protocols. They also assist with data analysis methods for multi-color analysis and sorting, cell cycle analysis, Ca²⁺ flux and FRET.

In addition to standard research instruments for flow cytometry, the FCF also houses the latest equipment for sorting large particles and entire 3D structures and organisms (e.g., seeds, organoids and c-elegans), as well as for imaging flow cytometry and spectral flow cytometry.

The FCF is intended for use by researchers at FBM, other UNIL faculties and outside entities (including companies, based on specific agreements).

Primary research equipment

Cell sorters (10–19 colors) – FACS Aria, Astrios and others

Sorter for large particles (3 colors) – Biosorter

Cell analyzers (10–30 colors) – BD LSR Fortessa, Cytotflex and others

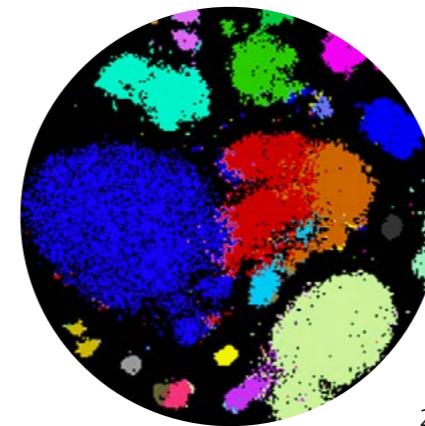
Imaging flow cytometer (10 colors) – ImageStream

Spectral flow cytometer (up to 40 colors) – Cytex Aurora

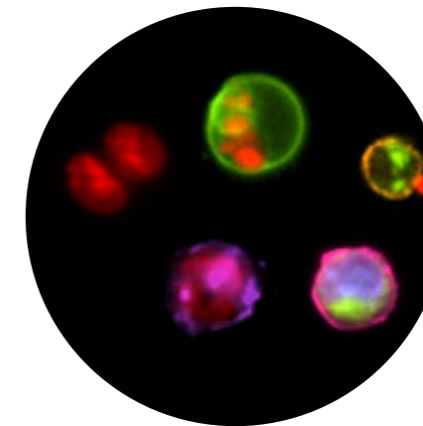
A full list of the equipment available at the FCF is given on its webpage.



1.



2.



3.

Main image: Streams during cell sorting

1. Clustering of flow cytometry data

2. Dimension reduction of flow cytometry data

3. Cells analyzed with imaging flow cytometry

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CAUTION
MOVING
PARTS

EXPERIMENTAL MODEL

IN VIVO IMAGING FACILITY ^{IVIF}

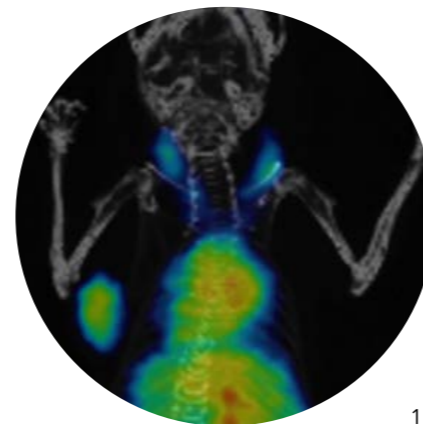
The In Vivo Imaging Facility (IVIF) carries out innovative, multimodal *in vivo* imaging to observe pathological processes in pre-clinical models ranging in scale from a single cell to the entire body – all based on minimally invasive methods. The IVIF operates 20 instruments at two facilities, one at the Agora cancer research center at Lausanne University Hospital (CHUV) and the other at the Biopôle at UNIL's Epalinges campus on the side of the animal facilities located at the same sites. IVIF staff assist and train researchers on magnetic resonance (MRI), positron emission tomography (PET) scans, 2D and 3D *in vivo* bioluminescence and fluorescence, computed tomography (μ CT), ultrasound, and both general and image-guided radiation therapy. The facility also provides state-of-the-art services in intravital multiphoton microscopy, including for surgery and data analysis.

The IVIF is intended for use by researchers at FBM, other UNIL faculties and outside entities (including companies, based on specific agreements).

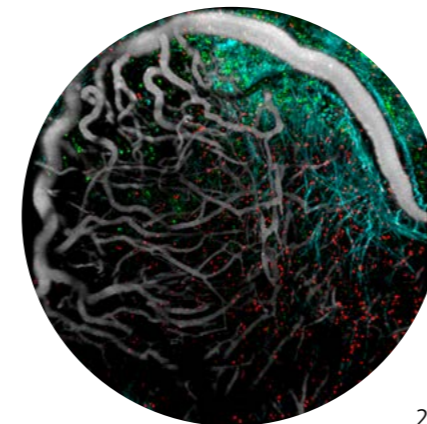
Primary research equipment

| |
|--|
| Multi-photon microscope (fully tunable), Leica SP8, Triscope II |
| Magnetic Resonance Imaging (MRI), 3T Bruker Biospec Maxwell |
| Micro computed tomography (X-Ray Micro CT), Bruker Skyscan 1276, MILabs |
| In vivo optical imaging (bioluminescence / fluorescence), IVIS lumina S5 & III |
| Positron Emission Tomography (PET scan), Bruker Albira & Si78 |
| Radiotherapy (RT), Xrad SmART plus, Xstrahl |
| Ultrasound, Fujifilm Vevo 3100 |

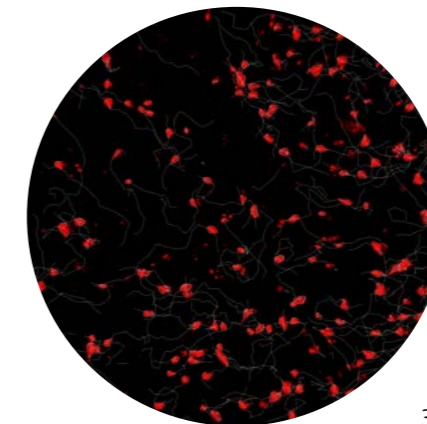
A full list of the equipment available at the IVIF is given on its webpage.



1.



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Main image: *In vivo* microCT of a mouse pelvis

1. *In vivo* PET/CT of a tumor-bearing mouse injected with a radiotracer
2. 4-color intravital 2-photon microscopy of a melanoma
3. Intravital time-lapse of tumor-infiltrating lymphocytes

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CARDIOVASCULAR ASSESSMENT FACILITY ^{CAF}

The Cardiovascular Assessment Facility (CAF) provides expertise for cutting-edge *in vivo* physiological assessments and runs a high-resolution ultrasound imaging system with state-of-the-art equipment. Its high-resolution system enables a full assessment of *in vivo* models for cardiovascular, cancer and kidney research. The CAF also performs advanced phenotyping with high-performance telemetry devices and carries out longitudinal studies consistent with 3R principles.

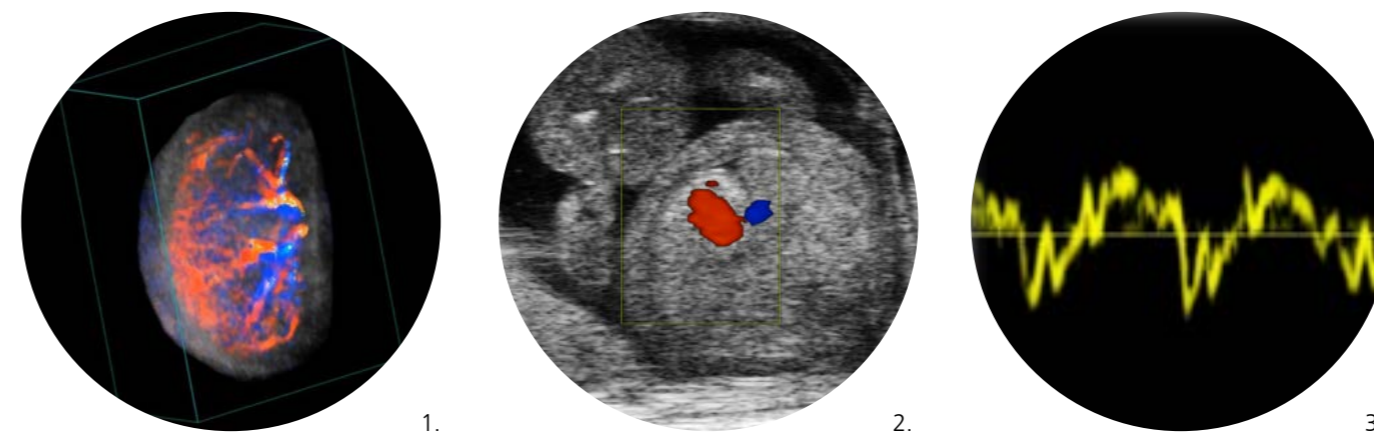
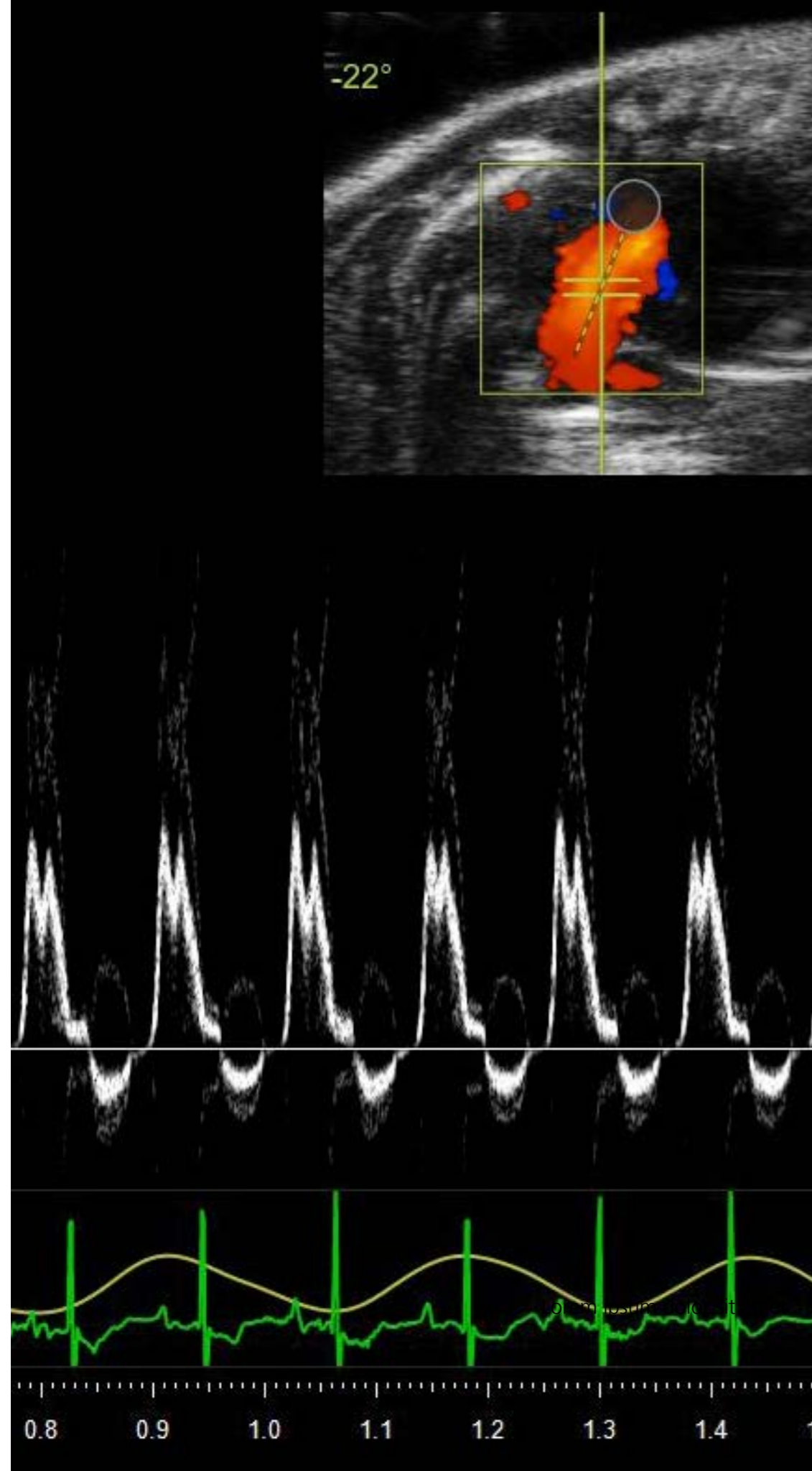
The CAF's unique skills in microsurgery (including for myocardial infarction in adults and newborns, transaortic constriction, Goldblatt hypertensive models, vessel catheterization, and intraventricular and intramyocardial injections), anesthesia and analgesia have led to the development of several innovative physio-pathological models, both *in vivo* and *ex vivo*. The facility's services include help with designing experiments, writing animal-testing requests, analyzing data and writing research reports. Its staff can assist with all experimental aspects of pre-clinical research.

The CAF is intended for use by researchers at FBM, other UNIL faculties and outside entities (including companies, based on specific agreements).

Primary research equipment

High resolution ultrasound imaging with Vevo 3100
 Telemetry devices for blood pressure measurements and ECGs

A full list of the equipment available at the CAF is given on its webpage.



Main image: Mitral inflow pattern
 1. 3D Kidney perfusion
 2. Color doppler of a mouse fetal beating heart
 3. Mitral tissue doppler imaging in mouse

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HISTOLOGY FACILITY ^{HF}

The Histology Facility (HF) offers standard histology services, including all types of histochemical staining, fluorescent IHC and HRP labeling, and protocol development (both new and ad hoc). Its staff help researchers establish and improve the histology methods used in their research. The HF operates at two sites: Épalinges and Agora. The Agora site consists of an open-access laboratory with various instruments, including cryostat, microtome and embedding stations. Researchers can also be trained on these stations.

The HF is intended for use by researchers at FBM, other UNIL faculties and outside entities (including companies, based on specific agreements).

Primary research equipment

CryoStar NX70 cryostat

MicromHM 355S microtome

Leica Histocore Arcadia paraffin embedding station

Leica ASP 300S VIP machine for paraffin embedding

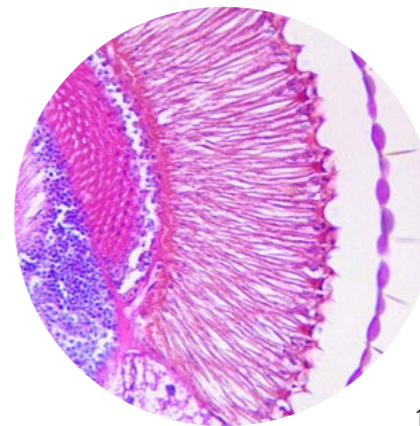
Equipment and buffers for HIER (low pH & high pH)

Slide hydration and dehydration columns

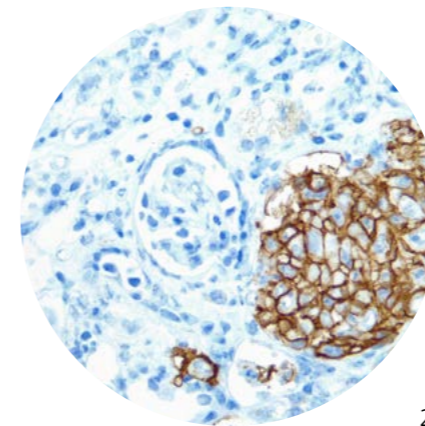
H&E manual staining station

Label printer for histology slides

A full list of the equipment available at the HF is given on its webpage.



1.



2.



3.

Main image: Mouse knee x10, Safranin O staining

1. Drosophila eye x40, H&E staining

2. Mouse kidney x40, CD44 staining

3. Zebrafish intestine x10, H&E staining

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PROTEOMICS

PROTEIN ANALYSIS FACILITY ^{PAF}

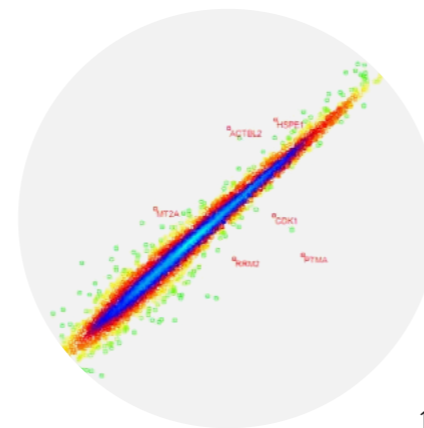
The Protein Analysis Facility (PAF) runs analyses of single proteins and proteomes. It employs advanced mass spectrometry methods to identify and quantify a large fraction of the proteins expressed in cells, tissues and organisms. The PAF also conducts large-scale profiling of post-translational modifications (e.g., phosphoproteome and ubiquitinome) using these same methods. Other common applications include the identification of protein-protein interactions and the study of proteomes of subcellular compartments. PAF staff provide comprehensive support at all stages, from experiment planning and sample preparation to data analysis. They also carry out fast, sensitive quantification of selected targets by capillary western assays as a complement to mass-spectrometry-based untargeted assays.

The PAF is intended for use by researchers at FBM, other UNIL faculties and outside entities (including companies, based on specific agreements).

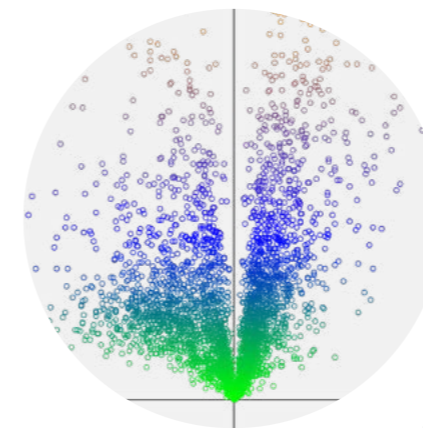
Primary research equipment

Thermo Fisher Scientific Exploris 480 Orbitrap mass spectrometer
 Thermo Fisher Scientific Bruker TIMS-TOF Pro mass spectrometer
 Thermo Fisher Scientific Fusion Trihybrid Orbitrap mass spectrometer
 Thermo Fisher Scientific nano - and micro-HPLC – 4x Ultimate-3000 systems
 Agilent 3100 off-gel peptide fractionation system
 GeSiM microarray nanoplotter
 Innopsys 710 IR near-infrared slide scanner
 JESS capillary western system with multi-imaging ProteinSimple

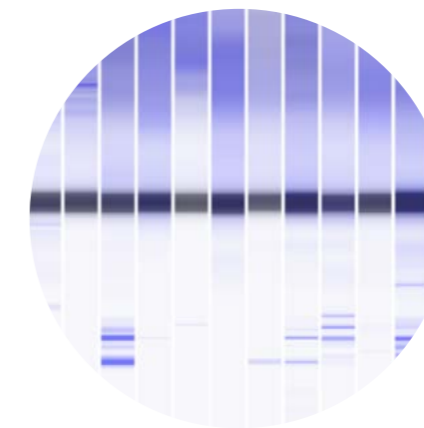
A full list of the equipment available at the PAF is given on its webpage.



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Main image: Detailed 2D map, total proteome analyzed by LC-MS

1. Scatter plot of protein intensities from a quantitative experiment
2. Volcano plot of fold changes vs p-values from a total proteome comparison
3. Capillary electrophoresis for quantitation of PDK4 including sample normalization

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METABOLOMICS



METABOLOMICS & LIPIDOMICS FACILITY^{MLF}

The Metabolomics & Lipidomics Facility (MLF) conducts advanced mass-spectrometry-based qualitative and quantitative analyses of metabolomes and lipidomes, which are small molecule complements of organelles, cells, organs and biofluids. The next-generation metabolic profiling carried out at the MLF is a powerful quantitative biology and high-throughput phenotyping approach that lets researchers measure metabolite abundances and deduce pathway activity (through labeling assays), thereby facilitating the study of metabolic mechanisms, from model systems to human population studies. MLF staff, working alone or in conjunction with specific research groups, aim to improve our understanding of the metabolite's role at the system level, in different physiological conditions (e.g., in healthy, ageing and diseased individuals) and in response to stimuli (e.g., treatments).

The MLF is intended for use by researchers at FBM, other UNIL faculties and outside entities (including companies, based on specific agreements).

Primary research equipment

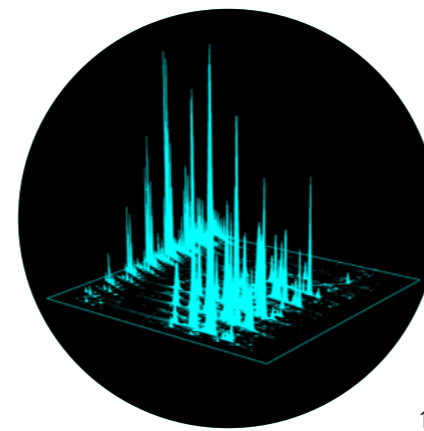
Ultra-high-performance liquid chromatography coupled with electrospray ionization high resolution mass spectrometry

- Quadrupole – Time of Flight (Q-TOF): 1 system
- Quadrupole Orbitrap: 1 system

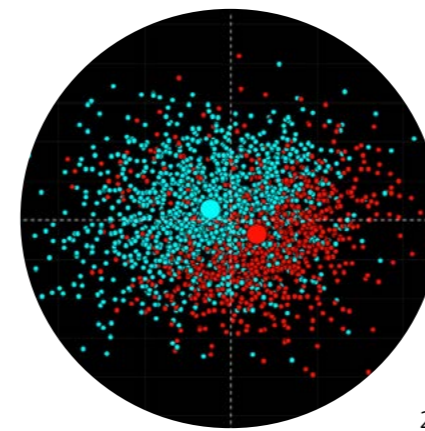
Ultra-high-performance liquid chromatography coupled with electrospray ionization tandem mass spectrometry

- Triple Quadrupole (QQQ): 3 systems

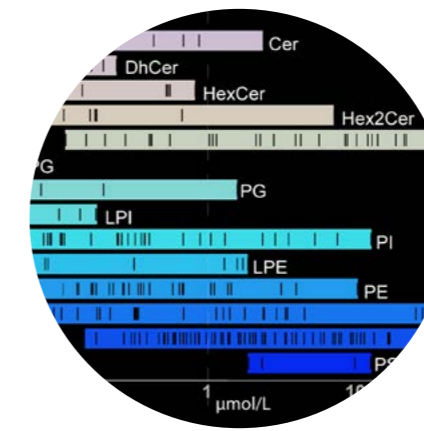
A full list of the equipment available at the MLF is given on its webpage.



1.



2.



3.

Main image: Metabolites mapped on KEGG pathways using iPath

1. Aligned metabolic profiles
2. Principal component analysis displaying human plasma clustering based on metabolic signatures
3. Bar plots displaying lipid concentration intervals

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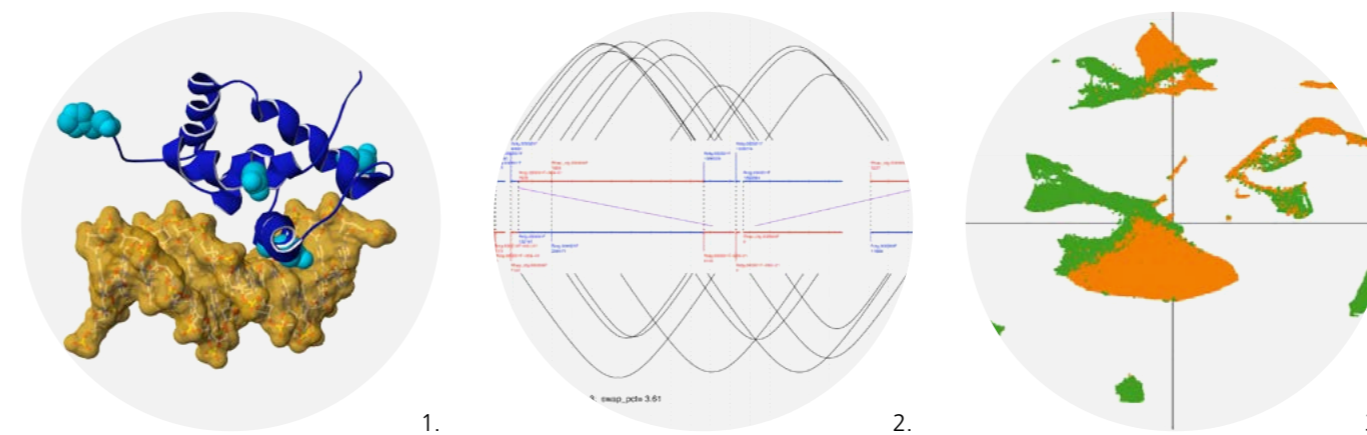
A photograph of a server rack in a data center, illuminated with a strong blue light. The rack is filled with multiple server units, each with a perforated front panel. Numerous blue network cables are plugged into the front of the servers and are bundled together on the right side. The overall scene conveys a sense of high-tech computing infrastructure.

BIOINFORMATICS
BIOSTATISTICS

BIOINFORMATICS COMPETENCE CENTER ^{BIDC}

The Bioinformatics Competence Center (BIDC) is run jointly by FBM and EPFL's School of Life Sciences. It provides highly specialized resources in bioinformatics for all aspects of data processing and analysis. Experts at the BIDC provide customized data analysis services that go beyond standard protocols to include project-specific algorithms, data processing pipelines, web reporting systems and visualization tools. The BIDC is currently working on a wide range of projects: bulk and single-cell RNAseq data analysis, alternative splicing, ChIPseq, ATAC-Seq, Hi-C, DNA methylation, genome assembly, flow and mass cytometry data analysis, the detection of mutations in tumors, the prediction of mutation effects on proteins, proteomic, lipidomic and metabolomic analyses, and data formatting, aggregation and presentation (such as on customized websites).

The BIDC is intended for use by researchers at FBM, other UNIL faculties, EPFL, and outside entities (including companies, based on specific agreements).



Main image: HiC map of chromosomal contact domains, insulation score and compartmental domain boundaries

1. Structural impact of genetic mutations
2. Genome assembly using PacBio and HiC data
3. Single cell data analysis

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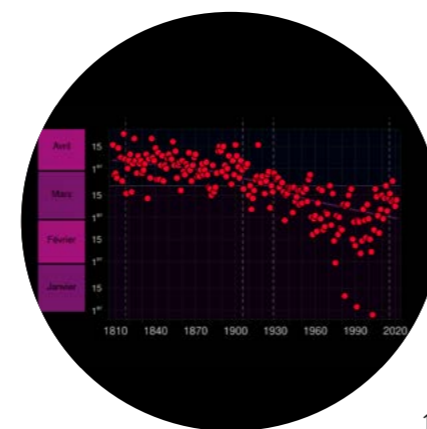
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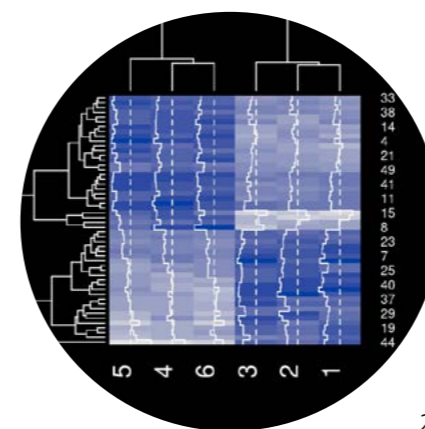
BIOSTATISTICS FACILITY ^{BSF}

The Biostatistics Facility (BSF) supports researchers with all aspects of biostatistics, including the analysis of data from high-throughput sequencing and the power analyses needed to prepare animal-testing requests. The BSF offers consulting services for all research steps requiring biostatistics: experimental design, writing grant applications, running the analyses and communicating the results. Its experts provide different forms of training such as courses, workshops, and tailored programs on specific statistical procedures for individual labs.

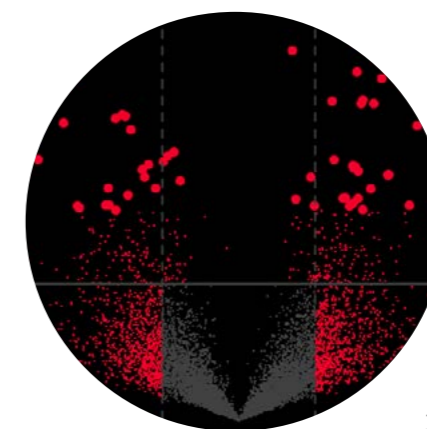
The BSF is intended for use by researchers at FBM, other UNIL faculties and outside entities (including companies, based on specific agreements).



1.



2.



3.

1. Modelling of the date of appearance of the first leaf of a tree along the years
2. Heatmap and dendrogram, indicating how six samples cluster into two groups
3. Volcano plot, indicating significantly differentially expressed genes in a transcriptomics experiment

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GENOMICS

GENOMIC TECHNOLOGIES FACILITY ^{GTF}

The Genomic Technologies Facility (GTF) mission is to provide access to state-of-the-art instruments, methods and support for measuring quantitative and qualitative variations in nucleic acids. Its experts are skilled in leading-edge genomics technology with a wide range of analytical applications. The GTF also offers ad hoc bioinformatics support and dedicated computing and storage infrastructure. It has the genomics expertise to help researchers choose the most appropriate technology for their research aims, improve their experimental design, run wet lab experiments, sequence libraries, perform primary data and biostatistical analyses, and manage data distribution.

The GTF is intended for use by researchers at FBM, other UNIL faculties and outside entities (including companies, based on specific agreements).

Primary research equipment

Illumina Novaseq 6000 sequencer

Illumina MiSeq sequencer

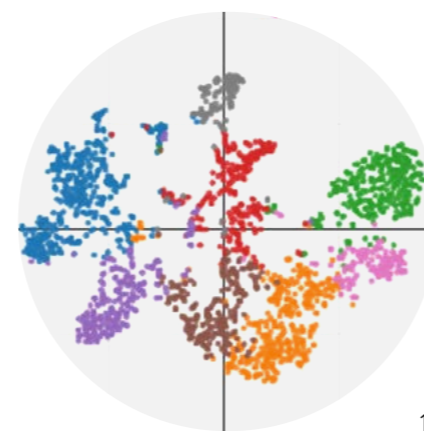
Pacific Biosciences Sequel II sequencer

10X Genomics Chromium X single-cell processor

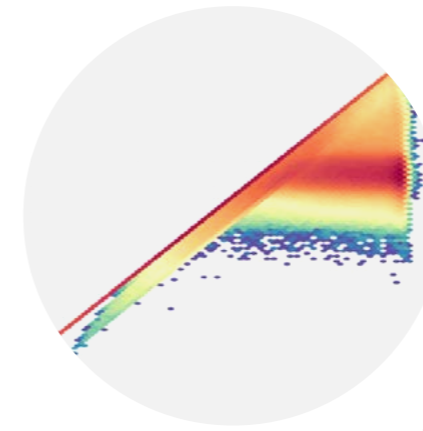
Thermo Fisher Scientific QuantStudio 5 and 6 real-time PCR systems

Sciclone, Myra and ViaFlo automation systems

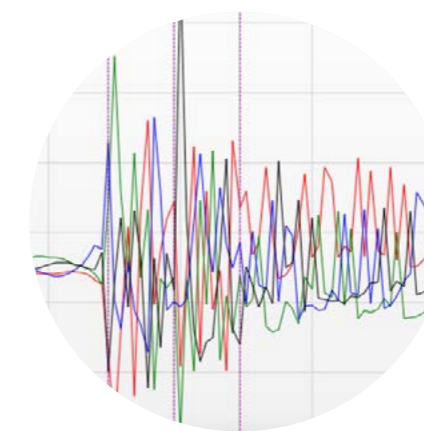
A full list of the equipment available at the GTF is given on its webpage.



1.



2.



3.

Main image: Loading of a short read sequencer, for a yield equivalent to 48 human genomes

1. Discrimination of different neuronal cells subtypes based on their gene expression program (t-SNE algorithm)

2. Long read sequencing quality metrics

3. Short read sequencing quality metrics

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HUMAN STUDIES

CLINICAL RESEARCH CENTER ^{CRC}

The Clinical Research Center (CRC) gives researchers and clinicians professional support for all aspects of clinical studies. This includes targeted assistance with methodology, statistics, regulatory compliance (documentation review, support to regulatory submissions), environments for eCRF/registry development (secuTrial®, REDCap®), data management, project management, study coordination, study nurse support, clinical investigation rooms, monitoring, and investigator and sponsor training approved by swissethics.

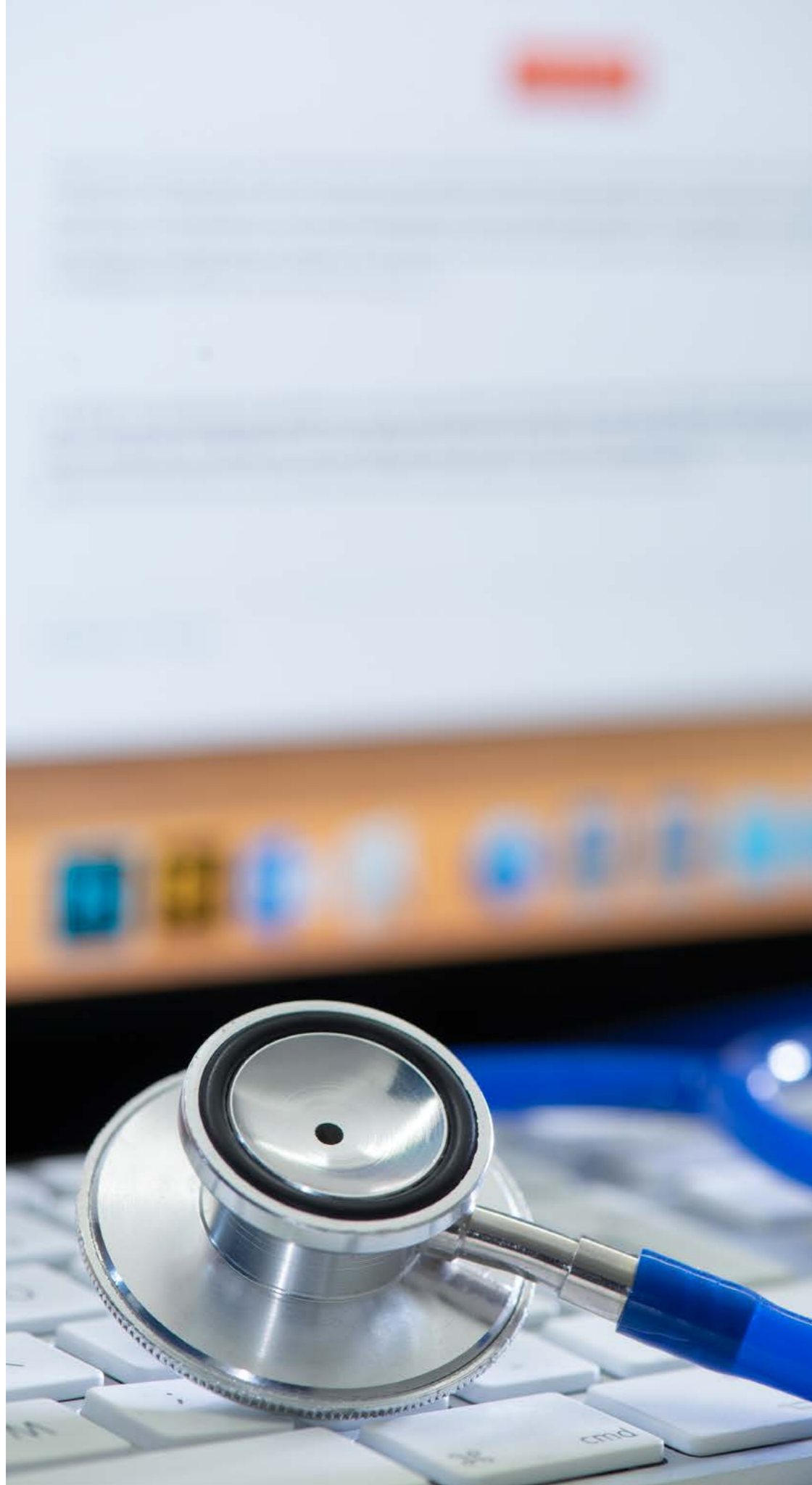
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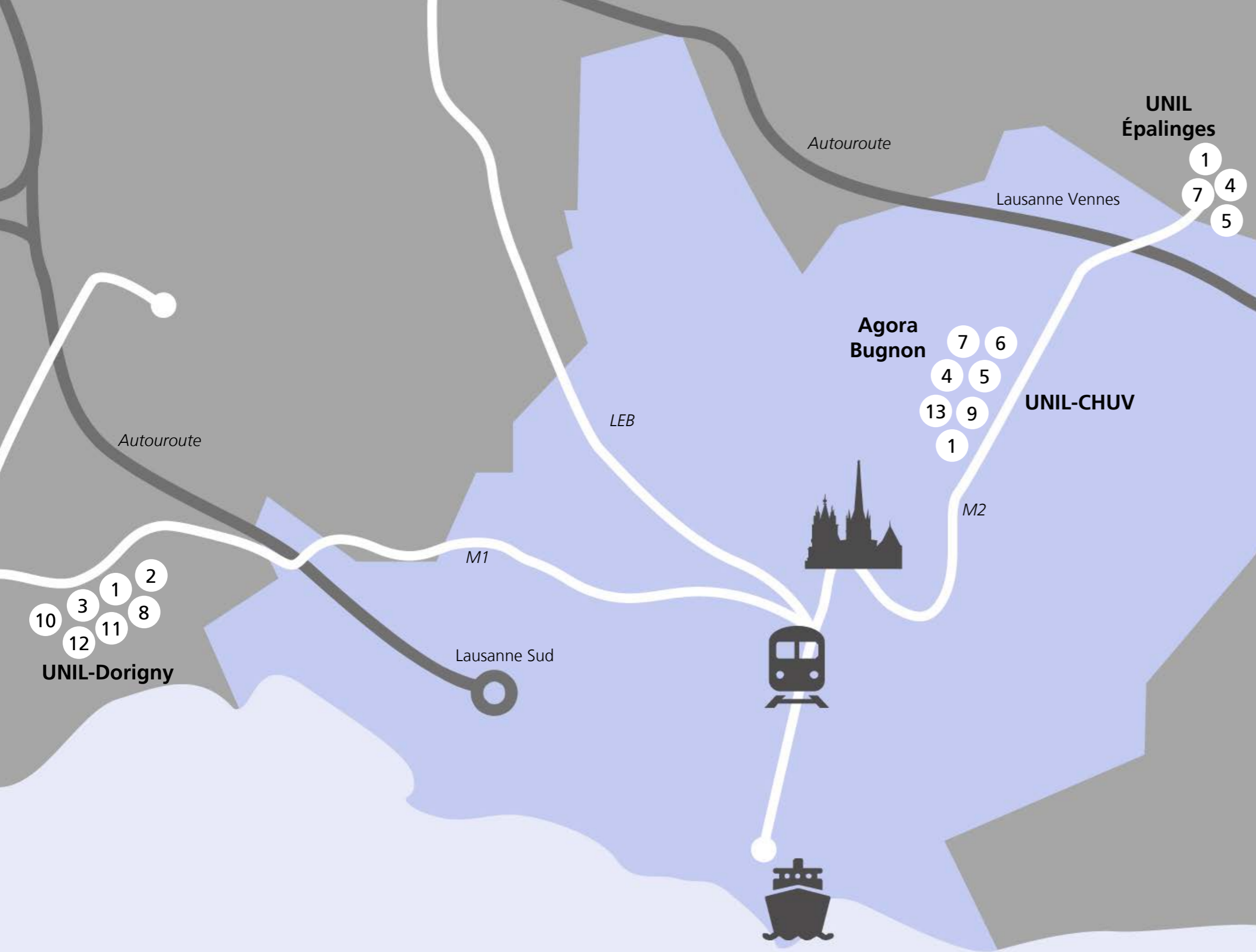
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LOCATION MAP

1. Cellular Imaging Facility ^{CIF}
2. Electron Microscopy Facility ^{EMF}
3. Dubochet Center for Imaging ^{DCI}
4. Flow Cytometry Facility ^{FCF}
5. In Vivo Imaging Facility ^{IMF}
6. Cardiovascular Assessment Facility ^{CAF}
7. Histology Facility ^{HF}
8. Protein Analysis Facility ^{PAF}
9. Metabolomics & Lipidomics Facility ^{MLF}
10. Bioinformatics Competence Center ^{BDC}
11. Biostatistics Facility ^{BSF}
12. Genomic Technologies Facility ^{GTF}
13. Clinical Research Center ^{CRC}

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