Fraunhofer

Fraunhofer Center Erfurt

Offering new technologies for the development, evaluation, manufacturing and monitoring of immunotherapies

The Fraunhofer Center in Erfurt (FZE) offers an innovative, interdisciplinary toolbox for investigations into cancer biology and immune-mediated disorders, with a focus on both trusted and cutting-edge technologies for analyzing cells and other biomaterials.

With its direct connection to the Fraunhofer Institute for Cell Therapy and Immunology (IZI) in Leipzig, one of the world's leading research institutes in the subject of cancer immuno-therapies, the team at FZE offers a range of expertise for advancing research in this quickly growing sector of the pharmaceutical industry.

At FZE, we bring together innovative, label-free technologies for characterizing single cells and bulk cell populations, set against the anchor points of trusted, state-of-the-art methods. As a project partner or service provider, FZE offers the unique ability to perform precision studies into cellular mechanics, metabolic processes and well-established cell phenotypes, in physiological or tumor-microenvironment-mimicking conditions.

These can be critical for the evaluation of candidate therapies in the pre-clinical phase, as well as offer new methods for quality control during manufacturing, or the establishment of novel companion diagnostics to monitor the course of the therapy.

Main offers

- Investigations into the biomechanical and morphological phenotypes of cells, blood and other materials through Real-time Deformability Cytometry (RT-DC)
- Characterization of small, volatile secretions related to metabolic processes through Gas Chromatography Ion Mobility Spectrometry (GC-IMS)
- Coupled studies into the mechanical and volatolomic phenotypes of cell populations, processes and biological materials
- State-of-the-art analyses of cells, blood-based materials and cell populations
- Implementation of hypoxic to normoxic conditions for 2D and 3D cell culture, with the ability for simultaneous, comparative studies

High throughput biomechanical and morphological characterization of cell populations

Competences

- High-throughput analysis of cell biomechanics (stiffness, deformability) and morphology by **Real-time Deformability Cytometry (RT-DC)**
- Correlative studies between mechanical / morphological (RT-DC) and classic (flow cytometry) cell phenotypes
- Immunostaining and cell labeling for flow cytometry and microscopy

Research topics

- Discovery and validation of biomechanical and morphological biomarkers for chronic diseases (long-Covid, autoimmune disorders) or therapy monitoring
- Investigation of the mechanical properties of cells and their influence from diseases such as cancer or autoimmune disorders
- Marker-free characterization of the mechanical and morphological properties in homogeneous and heterogeneous cell populations
- Analysis of cell morphology and protein localization by staining and labeling

Equipment

- Zellmechanik Dresden AcCellerator RT-DC: Platform for measuring the mechanical deformability and morphology of individual cells in high-throughput (label-free or up to 3 fluorescent markers)
- Cell staining: Set of reagents and devices for fluorescent cell labeling

Fingerprinting of secreted metabolites from cell populations

Competences

- Analysis and identification of Volatile Organic Compounds (VOCs) secreted from cells and living biological materials through **Gas Chromatography Ion Mobility Spectrometry (GC-IMS).**
- Development of culturing and measurement protocols for creating VOC profiles via GC-IMS
- Specialized analytical expertise in the detection of gaseous substances

Research topics

- Discovery and validation of biomarkers for diseases and cell processes (e.g. CAR-transduction) resulting from metabolic secretion of volatile organic compounds (VOCs)
- "Fingerprinting" VOC profiles in biological samples and materials connected to changing metabolic processes
- Development of quality or process control parameters for cell manufacturing processes based on VOC profiles

Equipment

- G.A.S. Dortmund GC-IMS: System for fast and precise analysis of VOCs in gas samples

Mimicking the hypoxic tumor microenvironment for biomedical research

Competences

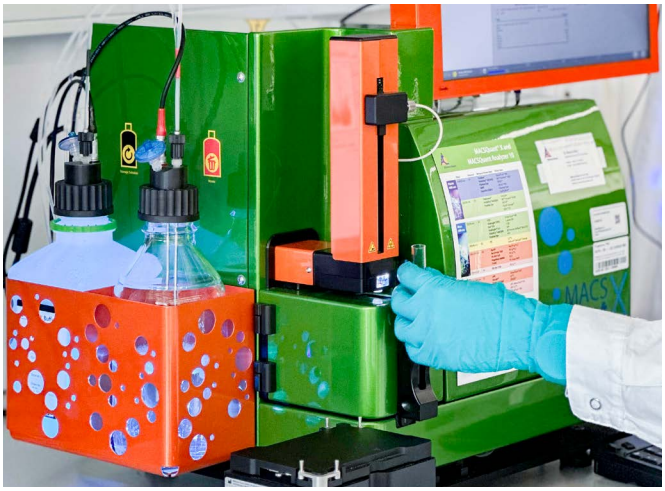
- 2D and 3D cell culture and analysis under controlled environmental conditions
- Side-by-side, differential cell cultures in hypoxic and normoxic conditions
- Long-term monitoring of living cells in stable environments Safe working with cell cultures according to BSL-1 guidelines

Research topics

- Investigation of cellular responses to low oxygen (hypoxic) concentrations in tumor and tissue models
- Real-time observation of dynamic cellular processes such as cell division, migration and interaction
- Cultivation of cells and microorganisms under controlled conditions
- Testing of anti-oncogenic therapeutic agents in conditions mimicking the tumor microenvironment

Equipment

- InvivO2® Hypoxia Workstation: Regulation of the oxygen content in cell culture environments
- Leica DMi1 THUNDER Imager: Microscope with integrated incubation chamber and image deconvolution



Preparation and analysis of biological samples: From single cells to tissues

Competences

- Gentle dissociation of tissue samples into single cells
- Complex flow cytometry experiments (up to 8 labels)
- Culturing and cryo-preservation of cells from monocultures, or obtained via tissue dissociation
- Performance & evaluation of enzyme-based assays (ELISA)

Research topics

- Characterization of cellular phenotypes in tumors
- Development of labeling agents or fluorescence surgical aids for cells and tissues
- Extraction and analysis of single cells from solid tissues
- High-throughput analysis marker expression on cells
- Characterizing blood materials for immune monitoring
- Quantification of proteins (cytokines) or other soluble molecule secreted by cells or present in blood material

Equipment

- Miltenyi MACSQuant® X Flow Cytometer: Precise flow cytometer for the quantification of cells
- Miltenyi gentleMACS™ Octo Tissue Dissociator: Mechanical and enzymatic dissociation of tissue into single-cell suspensions
- SpectraMax iD5 Multi-Mode Microplate Reader: Device for ELISA, etc.

Substrate functionalization and 3D printing of microfluidics

The Fraunhofer Center in Erfurt (FZE) is a collaborative innovation center between Fraunhofer IPMS, Dresden, Fraunhofer IZI, Leipzig, Fraunhofer IOF, Jena.

Competences

- Design and 3D printing of microfluidic chips according to specific experimental requirements
- Plasma etching for sterilization and activating organic and inorganic substrates
- Biofunctionalization of silicon-based substrates with proteins, nucleotides or other molecules

Research topics

- Production and adaptation of microfluidic chips for various applications in cell and molecular biology
- Surface modification of materials for improved cell adhesion
- Development of biofunctionalized substrates for biosensing applications
- Precise structuring of materials on a micro- and nanoscale

Equipment

- Deiner Atto Plasma Cleaner: System for the surface treatment of materials using reactive gas plasma technology
- Formlabs Form 3B 3D Printer: High-precision printer to produce microfluidic chips and other complex structures with µm features

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