Research profile for applicants

Name of DKFZ research division/group:	***Systems Immunology & Single-Cell Biology (D260)***
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Group homepage: *Visit this website for further information on current research and recent publications.*	https://www.dkfz.de/systemimmunologie-und-einzelzell-biologie

RESEARCH PROFILE AND PROJECT TOPICS

Research focus of the group

The Systems Immunology and Single-Cell Biology group investigates how interactions between tumor, immune, and stromal cells shape anti-tumor immunity and influence the success of cancer therapy. We are particularly interested in the role of cellular metabolism and in spatially organized microenvironments—or metabolic niches—that arise through nutrient availability, hypoxia, metabolite exchange, and cellular interactions within tumors. To study these processes directly in human tissues, we combine tumor immunology with spatial proteomics, metabolite imaging, experimental model systems, and computational biology. Our approaches include multiplexed ion beam imaging (MIBI), antibody-based single-cell metabolic profiling, spatial transcriptomics, mass spectrometry imaging, and machine-learning methods. By integrating these technologies, we aim to connect cellular identity, functional and metabolic state, and tissue organization with disease progression and treatment response. Our long-term objective is to identify biomarkers and biological vulnerabilities that can support more effective and personalized cancer therapies.

Potential postdoctoral projects

Postdoctoral projects can be developed along two complementary research directions and adapted to the candidate's expertise and interests.

One direction focuses on the computational analysis and integration of existing spatial-omics datasets from large human tumor cohorts. Projects may involve spatial proteomics, transcriptomics, metabolomics, or multimodal datasets and could address how cellular states, multicellular communities, and tissue niches change during tumor progression or therapy. The postdoctoral researcher could develop or apply computational and machine-learning approaches to identify recurrent biological programs, clinically relevant biomarkers, and spatial interactions associated with patient outcomes.

A second direction focuses on the experimental and mechanistic investigation of tumor–immune interactions. Projects may combine conventional and advanced cell-culture systems, CRISPR-based perturbations, patient-derived tumor organoids, immune-cell co-cultures, and mouse models. These systems can be used to test hypotheses emerging from human spatial-omics studies and to determine how selected genes, pathways, nutrients, or metabolites influence tumor growth, immune-cell activation, infiltration, and therapeutic response.

Both directions offer substantial scope for independent project development while benefiting from established datasets, experimental platforms, clinical collaborations, and expertise in spatial biology, immunology, cancer metabolism, and computational analysis.