

Project abstract

Name of DKFZ research division/group:	Microbiome and Cancer (D480)
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Group homepage: Please visit our website for further information on our research and recent publications.	https://www.dkfz.de/en/microbiome-and-cancer

PROJECT PROPOSAL

The research division Microbiome and Cancer, a bridging division between DKFZ Heidelberg and the Weizmann Institute of Science, Israel, headed by Professor Eran Elinav studies the cross-talk between cancer cells, immune cells, microbial colonization, and other environmental factors. We investigate how individual bacteria, microbial consortia or microbial perturbations through diets or xenobiotics interplay with metabolic disruption, chronic inflammatory responses to impact on carcinogenesis or metastasis in a variety of preclinical models. We also study the longitudinal cross-talk of cancer therapies with the gut microbiota in patients and in mouse models to investigate causal relations, e.g., by direct bacterium-host cell interactions or via microbial metabolites.

We are using well-established, cutting-edge wet-lab techniques combined with bioinformatic tools to sequence and analyse the microbiota from the oral cavity and different sites of the gastrointestinal tract. We are covering the whole range of microbiome analyses from bacteria to fungi both with high-resolution metagenome sequencing techniques. This approach is combined with multi-omics characterisation of the host's immune system on the level of individual cells by single cell RNA sequencing and proteome or metabolome analyses. In order to transfer this knowledge back into the clinic for the benefit of patients, we are performing precision medicine-based, clinical studies with patient microbiota interventions using specific dietary modifications or microbiota transfers



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The advertised project aims to elucidate the nature and timing of cross-talk within the microenvironment during the development of Pancreatic Ductal Adenocarcinoma (PDAC). A particular focus will be laid on changes in tumor transcriptional profiles and microbial abundances with spatial and temporal resolution. The successful candidate will use state-of-the-art spatial gene expression and microbial profiling techniques to unravel microniches characterized by specific microbial consortia. These will in turn be linked to the changing metabolic and immune cell profiles of the emerging tumors. By analyzing PDAC development from this spatial, microenvironmental angle, this project is set to uncover new mechanisms of transformation, immune cell interaction and tumor metabolism based on the changing microbiome composition. Such insights are desperately needed to transform the prevention and treatment of one of the most devastating tumor types.

This research will comprise a multi-omics approach with next-level sequencing of the microbiome, host and microbial metabolomics, culturomics, advanced immune cell flow cytometry and state-of-art bioinformatic methods for high-resolution spatial microbiome and transcriptome analyses. To enable translational sciences, it will cover in vitro and in vivo research from cell, organoid and microbe cultures to laboratory animal work, up to germ-free and gnotobiotic research models. The scientific context of the project will be provided by an international scientific exchange within a research consortium led by Prof. Eran Elinav that connects the Microbiome and Cancer Research Division at DKFZ with the Weizmann Institute of Science in Israel. The successful candidate will be able to steer their clinician scientist project with support from weekly input sessions with Prof. Elinav and senior division personnel, as well as the unique collaboration potential from both the DKFZ and Weizmann Institute Elinav groups.



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