Research profile for applicants

Name of DKFZ research division/group:	***CCU Translational Radiation Oncology (E210)***
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Group homepage: *Visit this website for further information on current research and recent publications.*	https://www.nct-heidelberg.de/en/research/precision-local-therapy-and-image-guidance/radiation-oncology.html

RESEARCH PROFILE AND PROJECT TOPICS

Research focus of the group

The BioPT Group at NCT and CCU Translational Radiation Oncology develops and validates personalized particle-therapy strategies spanning experimental radiobiology, Monte Carlo dose and LET calculation, radiobiological modelling, treatment planning and clinical translation. A particular focus is the optimal use of protons and heavier ions, including helium, carbon and oxygen, to improve tumour control while reducing dose and biological injury in normal tissues, thereby supporting the prevention of treatment-related toxicity and long-term sequelae. The BioPT Group operates within the interdisciplinary environment of the National Center for Tumor Diseases (NCT) Heidelberg at DKFZ and Heidelberg Ion-Beam Therapy Center (HIT), Heidelberg University Hospital, providing access to clinical beams, irradiation facilities, patient data and expertise across medical physics, radiation biology and oncology.

Potential postdoctoral project: Biology-guided particle therapy for aggressive breast cancer: preventing local recurrence while sparing normal tissue

Building on our radiobiological and treatment-planning study, which identified helium-ion therapy as offering a promising balance between physical precision and biological effectiveness, the project will investigate how particle therapy can widen the therapeutic window in aggressive breast cancer. The postdoctoral researcher will develop a framework to identify which tumour phenotypes and patients are likely to benefit from proton, helium-ion or heavier-ion therapy, aiming to prevent local recurrence and limit treatment-related toxicity.

Clinically realistic spread-out Bragg peaks will be studied in 2D and 3D models of aggressive breast cancer and normal tissues. Endpoints will include clonogenic survival, spheroid growth delay and post-treatment regrowth as preclinical indicators relevant to recurrence prevention, together with migration/invasion and treatment-induced molecular responses. The data will be used to derive and validate ion- and endpoint-specific radiobiological models linked to dose, LET and beam quality. These models will inform comparative and biologically optimized treatment-planning studies in breast-cancer patient datasets, assessing target coverage, organ-at-risk sparing, robustness and predicted complication risk. Quantitative imaging, computational modelling and, where appropriate, machine-learning methods will be explored to identify predictive biomarkers and support patient stratification.

The project is suited to a researcher combining experimental radiobiology with quantitative and programming skills. It will deliver validated models, reproducible analysis tools and testable hypotheses for biology-guided prevention of recurrence and treatment-related toxicity in aggressive breast cancer.