# Multiscale Modeling of Tumor Development

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The temporal and spatial resolution in the microscopy of tissues has increased significantly within the last years, yielding new insights into the dynamics of tissue development and the role of the single cell within it. A thorough theoretical description of the connection of single cell processes to macroscopic tissue reorganizations is still lacking. Especially in tumor development single cells play a key role in the advance of tumor properties.

We introduce a scale-bridging method that is able to model tissue development up to the centimeter scale with micrometer resolution of single cells. Through parallelization it enables the efficient use of HPC systems, therefore facilitating detailed simulations on a large scale. We developed a generalized tumor model that respects adhesion driven cell migration, cell-to-cell signaling and mutation driven tumor heterogeneity. We scan the response of the tumor development and composition in dependence of different treatment plans using chemotherapy as well as radiation therapy. We then investigate how the presence of tumor stem cells changes tumor evolution, composition and treatment response. With this model, we enable *in silico* medicine to deepen the theoretical understanding of the interplay of tissue and single cells and therefore moving towards to computational personalized medicine.