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A Computational Model of Vascular Tumour Growth as Observed by Intravital Microscopy through a Dorsal Skinfold Chamber on the Mouse

A computational model is potentially a powerful tool to apprehend complex phenomena like solid tumor growth, and to predict the outcome of therapies in order to find the best solution to fight the disease. To that end, the confrontation of the model with biological experiments is essential to validate this tool.

In this poster, we present a model specifically constructed to match and interpret biological results obtained in vivo on mice by the dorsal chamber method. We will focus especially on the vascular adaptation and alteration of the blood rheology. In order to reproduce the tumor evolution, interrelation between vascular development and tumor growth are established thanks to oxygen diffusion and the angiogenesis process. Indeed, oxygen is transported to the tumor by the vessels and hypoxia induces the growth of new blood vessels via the emission of vascular endothelial growth factors by the tumour cells. Vascular collapse in tumor is also taken into account as well as dilation or constriction of the vessels.

Simulations based on existing vascular network and measured rheological parameters reproduce the observed tumour evolution including the increased vascular density at the periphery and the formation of a necrotic core. Biological results obtained by the dorsal chamber method and numerical simulation results are further compared to calibrate the model so as to use it as a predictive tool in order to further test and design new therapy protocols.