AbstractID: 7438 Title: Model for development of Tumor Vasculature based on Monte Carlo simulations

Purpose: The work aims to simulate growth of tumor vascular structure, based on the anatomical and biological information obtained from a contrast-enhanced CT and hypoxia PET images. The model would be beneficial for optimization in anti-angiogenic therapy.

Materials and Methods: The vascular structure was simulated as a two dimensional matrix. MATLAB environment was used in simulations. An upper limit on the vascular density was fixed and vessels were grown from a given root vessel into the space of a specific size. The vessel thickness was simulated variable, with vessels thinning as they grew. The vessel node selected for sprouting is the one which has the least density of oxygen around it. The direction in which the vessel sprouts is calculated by checking on the least dense direction around it using Monte Carlo simulation, and considering into account that vessels have a tendency to grow forwards.

Results: The developed vasculature growth model was successfully implemented. The thicker vessels grown correspond to the thicker blood vessels and the thinnest ones to the capillaries. The density of the vasculature could be successfully controlled and modified to achieve tumor vasculature growth in the region required. A region of higher vasculature density corresponds to a less hypoxic region and vice-versa. A known hypoxia map and an initial vasculature structure are the only requirements for the simulation.

Conclusions: Micro-PET/CT images acquired *in vivo* provide the basic information needed for tumor growth simulations. The model could be applied as an effective tool for optimizing anti-angiogenic therapies, when fully benchmarked to the experimentally measured conditions. The vasculature growth in a three dimensional matrix is expected to put a much more severe restriction on the computational power needed.