# How tumor vessel network morphology determines oxygen concentration

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Oxygenation of tissue depends strongly on the spatial arrangement of blood vessels. During tumor growth the hierarchically organized arterio-venous blood vessel network of the host tissue is transformed into a chaotic heterogeneously distributed tumor vasculature. To investigate this direction we consider algorithmically constructed blood vessel networks and analyze the resulting intravascular oxygen concentration distribution. The fact that oxygen has a very small diffusion range, results in a strong dependence of the oxygen distribution on the location of the vessels. Combined with a low vascular density in tumors, this leads to severe hypoxia which plays an important role in cancer invasion and impedes treatment. Our method computes intra-vascular transport, and extravascular diffusion of oxygen self consistently, where vessels are sources and drains of oxygen. Tumor cells are represented by a continuum approach. We were able to handle system sizes of 8 mm diameter where typical features of tumor vascular morphology manifest themselves. We correlate physiological and topological variations with local oxygen availability and quantitatively reproduce IR mammography data showing the oxygen content of breast carcinomas in vivo. [1]

[1] PLOS Comp. Biol (submitted)