STOCHASTIC MODELLING OF TUMOUR-INDUCED ANGIOGENESIS

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A major source of complexity in the mathematical modelling of an angiogenic process derives from the strong coupling of the kinetic parameters of the relevant stochastic branching-and-growth of the capillary network with a family of underlying fields, which are then themselves random. Methods for reducing complexity include homogenization at a mesoscale, e.g. by (locally) averaging the stochastic cell, or vessel densities in the evolution equations of the underlying fields, while keeping stochasticity at lower scales, possibly at the level of individual cells or vessels. This kind of models are known as hybrid models. Here, as a case study, a simplified stochastic geometric model is presented, for a spatially distributed angiogenic process, strongly coupled with a set of relevant underlying fields. The branching mechanism of blood vessels is modelled as a stochastic marked counting process describing the branching of new tips, while the network of vessels is modelled as the union of the trajectories developed by tips; capillary extensions are modelled as a system of a random number of Langevin type stochastic differential equations, coupled with the random PDE's describing the evolution of the underlying fields involved in the process.

REFERENCES

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