A model of retinal vasculogenesis

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Vasculogenesis is the early stage of blood vessel formation process - angiogenesis. It occurs by a de novo production of endothelial cells in the embryo and is rather complex and still not completely understood. We present some modifications and improvements of previous microscopic models of vasculogenesis.

In the model the endothelial cells are divided into tho types: the tip cells that lead the process and mural cells that build vessels. We construct a stochastic individual based hybrid model in which tip cells movement is described by Langevin-type system of equations

$$\begin{cases} d\mathbf{X}_i(t) = & \mathbf{V}_i(t)dt \\ d\mathbf{V}_i(t) = & [-k\,\mathbf{V}_i(t) + F(\nabla g(t,x), \nabla u(t,x))]dt + \sigma dW_i(t), \end{cases}$$

coupled to the two fields of chemical factors u and g (nutrient and *vascular endothelial growth factor*) that evolve according to PDEs. Cells undergo proliferation and changes.

The aim of this talk is to discuss simpler and more complex version of the model and their behaviour in the limit of large number of cells. Some numerical simulations will be presented.