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Cell dispersal: some nonparametric and multiscale aproaches

We provide a short overview of the current approaches to modeling cell motion through various media, thereby focussing on the model scales, ranging from the microscopic, intracellular level through the mesoscale of the joint action of population constituents toward the behavior of the entire population on the macroscopic level.

In this context we propose and analyze a multiscale model for bacterial motility in the framework of partial differential equations. Further we present an alternative approach which relies on stochastic processes accounting for the underlying motion phenotype and uses a nonparametric statistical technique in order to directly assess the macroscpic cell population density from data (if available) or numerical simulations of the cell trajectories. This nonparametric approach allows to handle detailed multiscale models in a complexity which in the context of PDEs is still prohibitive for the numerics.

We will also provide an outlook on the potential of the method for further interesting biomedical problems.