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Mathematical models in medicine: an approach via stochastic homogenization of the Smoluchowski equation

Abstract

In this work, we apply the theory of stochastic homogenization to find the asymptotic behavior of the solution of a set of Smoluchowski's coagulation-diffusion equations with non-homogeneous Neumann boundary conditions. This system is meant to model the aggregation and diffusion of beta-amyloid peptide in the cerebral tissue, a process associated with the development of Alzheimer's disease. We assume a stochastic model for the spatial distribution of neurons (random media). Further, we consider random diffusion coefficients for the amyloid aggregates and a random production of amyloid beta peptide in the monomeric form at the level of neuronal membranes.