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The Cell Growth and Division Can Destroy Stem Cell Niche in a Reaction-Diffusion Model

A minimal 1D-model of stem cell niche structure regulation along vertical axis of the SAM was developed on the basis of a qualitative hypothesis of interplay between the CLV and WUS genes. Previously it was shown that there is a set of parameters supplying a stationary solution in qualitative correspondence with experimental observations. But the question arises what will be the model dynamics under cell growth and division.

Using DL-system formalism we developed a mathematical model of stem cell niche structure regulation on 1D-array of growing and dividing cells. A number of computer simulations were performed to study the model dynamics.

In the issue the dependence of probability of the stem cell niche destruction on cell cycle duration relative to diffusion time scale was obtained. Increase of the specific cell growth rate results in monotonic increase of system destruction probability and in decrease of its mean lifetime.

Cell divisions account for relevant perturbation in the SAM structure and may result in destruction of it. The stem cell niche survivability depends on relations between model parameters.