
Traveling wave fronts in a coupled delayed reaction-diffusion and difference system

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Abstract

The formation and development of blood cells (red blood cells, white cells and platelets) is a very complex process, called hematopoiesis. This process involves a small population of cells called hematopoietic stem cells (HSCs). We propose a mathematical model describing the dynamics of HSC population, taking into account their spatial distribution and diffusion. The resulting model is an age-structured reaction-diffusion system. The method of characteristics can be used to reduce this model to an unstructured time-delayed reaction-diffusion equation coupled with a difference equation. We investigated mathematical studies of the model and showed the existence of travelling wave front solutions connecting the zero equilibrium with the positive uniform steady state. We used the classical monotone iteration technique coupled with the sub- and super-solutions method. A numerical simulations carried out to show the propagation of the solution in a travelling wave front.

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