Mathematical models of pathogen interactions with the immune system

Francisco J. Solis[1], Danalie de los Angeles Azofeifa Chaves[1]

[a] *CIMAT, Center of research in mathematics, Guanajuato Gto. México 36000,*

Abstract

The elimination of pathogens in an organism is a function of the immune system. The cells involved in this process are primarily macrophages and neutrophils. The process of our interest consists of two stages: the first stage is the possibility of eradicating the pathogen and the second is the possibility of resolving the inflammation. In this work we present variations of a differential model whose variables measure density of involved cells and levels of inflammation. Our objective is to show the possible eradication of the pathogen or resolution of inflammation. Bifurcation techniques are used to analyze how the values of the parameters can affect the evolution of the systems. Our research determines that the Elimination of neutrophils eliminated by macrophages has a dichotomous effect: harms or benefits the elimination of the pathogen. In addition, cases are discovered where the pathogen could not be eliminated.

Email addresses: solis@cimat.mx (Francisco J. Solis), danalie.azofeifa@cimat.mx (Danalie de los Angeles Azofeifa Chaves)

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