ORAL COMMUNICATION

Equations modeling spatial patterns for immunological dysfunctions: from kinetic to macroscopic scenario

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Abstract

We present a study for anomalous immune response that extends the one proposed in [1], where a kinetic model is proposed to describe, at mesoscopic level, the dynamics in time of a high number of interacting cells in an autoimmune framework. We propose a more realistic spatio-temporal model describing both interactions among different populations of human cells and motion of immune cells, stimulated by cytokines [2]. We fix a time parameter and assume that processes considered occur at different scales. This allows to perform a formal hydrodynamic limit, obtaining macroscopic reaction-diffusion equations for the number densities of the constituents with a chemotaxis term. A natural step is then to study the system, inquiring about the formation of spatial patterns through a Turing instability analysis of the problem and basing the discussion on microscopic parameters of the model. We then apply the procedure to a particular case of autoimmune disease represented by Multiple Sclerosis. In this case we get spatial patterns that reproduce brain lesions characteristic of the pathology.

Keywords Kinetic theory, Multicellular systems, Chemotaxis, Turing instability, Pattern formation

References

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