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Stability analysis of a model of atherogenesis: an energy estimate approach. II. (English)

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[For part I of this paper see ibid. 9, No. 2, 121–142 (2008; Zbl 1140.92011).]

Summary: This paper considers modelling atherogenesis, the initiation of atherosclerosis, as an inflammatory instability. Motivated by the disease paradigm of *R. Ross* [New Engl. J. Med. 340, No. 2, 115–126 (1999)] atherogenesis is viewed as an inflammatory spiral with positive feedback loop involving key cellular and chemical species interacting and reacting within the intimal layer of muscular arteries. The inflammation is modelled through a system of nonlinear reaction-diffusion-convection partial differential equations. The inflammatory spiral is initiated as an instability from a healthy state which is defined to be an equilibrium state devoid of certain key inflammatory markers. Disease initiation is studied through a linear, asymptotic stability analysis of a healthy equilibrium state. Various theorems are proved giving conditions on system parameters guaranteeing stability of the health state and conditions on system parameters leading to instability. Among the questions addressed in the analysis is the possible mitigating effect of anti-oxidants upon transition to the inflammatory spiral.

MSC:

92C50 Medical applications (general)
35K57 Reaction-diffusion equations
35Q92 PDEs in connection with biology, chemistry and other natural sciences
92C37 Cell biology
35K55 Nonlinear parabolic equations
35B35 Stability in context of PDEs

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