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Atherogenesis refers to the initiation of atherosclerosis—a disease characterized by the accumulation of lipid laden immune cells and cellular debris in the walls of large muscular arteries. Chronic inflammation is a principal component of the disease process which involves the accumulation and oxidation of low density lipoproteins (LDL) within the arterial wall and the inability of macrophages to perform normally in the presence of oxidized LDL. We present a reaction-diffusion model involving chemotaxis of certain bio-chemical processes involved in the disease, and propose that initiation of cellular aggregation can be viewed as a mathematical instability. We perform stability analyses accounting for immune cell subspecies interactions, differing roles of immune cells with respect to the components of an emerging lesion, the effects of anti-oxidants, and boundary transport. (Received July 20, 2011)