1060-76-137 **David Saintillan*** (dstn@illinois.edu), 1206 West Green Street, 126 Mechanical Engineering Building, Urbana, IL 61801. *Modeling and simulation of biologically active suspensions.*

Biologically active suspensions, of which a bath of swimming bacteria is a paradigmatic example, are fluid systems whose microstructure is motile, and constitute a fundamental example of nonequilibrium pattern-forming systems. In this work, we apply a kinetic theory previously developed by Saintillan and Shelley (*Physics of Fluids*, **20** 123304, 2008) to study the nonlinear dynamics and pattern formation in active suspensions in a variety of situations. We first consider the case of a uniform isotropic suspension, where we show using a linear stability analysis that long-wavelength fluctuations are unstable as a result of hydrodynamic interactions. The long-time dynamics and pattern formation are studied using large-scale three-dimensional numerical simulations, where we report results on the coherent structures that are seen to emerge and their relation to the disturbance flows driven by the particles. Second, we extend this study to investigate the effects of an external shear flow: in this case, it is found using a stability analysis that the external flow is stabilizing at high shear rates, and nonlinear simulations demonstrate the existence of several regimes of instability at low and moderate shear rates. (Received March 28, 2010)