

Abstract for a contributed talk submitted to the
Conference on Computational Physics 2013

Topic: Statistical Physics & Complexity

Large-scale simulations shed new light on causes of age-related macular degeneration

Fereydoon Family

Department of Physics, Emory University, Atlanta, GA 300322, USA

Age-related macular degeneration (AMD) is a debilitating eye disease and the leading cause of blindness in adults. We have developed a large-scale statistical mechanical model of the retina and studied the growth, patterning and progression of AMD. The computational approach allowed us to explore and quantitatively test many more combinations of hypotheses and parameter choices than would have been experimentally feasible. Our results suggest that new mechanical instabilities due to adhesion failure at the cell level are the dominant cause of the initiation and progression of neovascularization in AMD. This unexpected finding demonstrates the power of computational modeling approaches for studying complex biological system. Our findings will have a significant effect on the future development of targeted intervention strategies and clinical treatment of AMD.

Coauthors: A. Shirinifard, J. Glazier, M. Swat, Y. Jiang, J. Scott Gens, Y. Jiang, H. Grossnicklaus