SES09-2009-000070

Abstract for an Invited Paper
for the SES09 Meeting of
the American Physical Society

Physics of Age Related Macular Degeneration

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Age-related macular degeneration (AMD) is the leading cause of blindness beyond the age of 50 years. The most common pathogenic mechanism that leads to AMD is choroidal neovascularization (CNV). CNV is produced by accumulation of residual material caused by aging of retinal pigment epithelium cells (RPE). The RPE is a phagocytic system that is essential for renewal of photoreceptors (rods and cones). With time, incompletely degraded membrane material builds up in the form of lipofuscin. Lipofuscin is made of free-radical-damaged protein and fat, which forms not only in AMD, but also Alzheimer's disease, and Parkinson's disease. The study of lipofuscin formation and growth is important, because of their association with cellular aging. In this talk I will discuss a model of non-equilibrium cluster growth that we have developed for studying the formation and growth of lipofuscin in AMD [K.I. Mazzitello, C.M. Arizmendi, Fereydoon Family, H. E. Grossniklaus, Physical Review E (2009)]. I will also present an overview of our theoretical and computational efforts in modeling some other aspects of the physics of AMD, including CNV and the breakdown of Bruch's membrane [Ongoing collaboration with Abbas Shirinifard and James A. Glazier, Biocomplexity Institute and Department of Physics, Indiana University, Y. Jiang, Los Alamos, and Hans E. Grossniklaus, Department of Ophthalmology, Emory University].