Bottega, William J.; **Bishay, Peter L.**; **Prenner, Jonathan L.**; **Fine, Howard F.**
On the mechanics of a detaching retina. (English) ⟦Zbl 1278.92008⟧

Summary: A mechanics-based mathematical model for retinal detachment is developed, incorporating an energy-based criterion for propagation. Retinas with and without central tears are considered and contraction of the vitreous and extension of its fibrils, along with a pressure difference across the retina, are taken as the stimuli for detachment propagation. In addition to the equations of motion, boundary and matching conditions, the variational formulation yields the self-consistent energy release rate that governs detachment, and formulae for critical stress and critical deflections that provide a rational basis for measuring critical parameters.

Exact analytical solutions are established for axisymmetric detachment of retinas with and without tears, and numerical simulations are performed based on these solutions. The results yield characteristic behaviour, including threshold levels and stability of detachment, 'dimpling' of the detaching retina, the effects of changes in material and geometric parameters, and the influence of the presence and size of the retinal tear on detachment propagation. The model predicts that once detachment ensues it does so in an unstable manner and is extensive in scope. This is in agreement with clinical observations. The results also suggest that, under appropriate conditions, the presence and size of a retinal tear or hole can have a 'stabilizing' effect with regard to detachment propagation.

MSC:

92C30	Physiology (general)
92-08	Computational methods for problems pertaining to biology

Cited in **1** Review
Cited in **2** Documents

Keywords:

retinal detachment; retinal tear; retina; vitreous contraction; vitreous fibril tension; subretinal pressure; spherical shell; elastic foundations

Full Text: DOI