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Modeling Tear Film Evaporation and Breakup with Duplex Films[1] MICHAEL STAPF, RICHARD BRAUN, University of Delaware, CAROLYN BEGLEY, School of Optometry, Indiana University, Bloomington, IN, TOBIN DRISCOLL, University of Delaware, PETER EWEN KING-SMITH, College of Optometry The Ohio State University, Columbus, OH — Tear film thinning, hyperosmolarity, and breakup can irritate and damage the ocular surface. Recent research hypothesizes deficiencies in the lipid layer may cause locally increased evaporation, inducing conditions for breakup. We consider a model for team film evolution incorporating two mobile fluid layers, the aqueous and lipid layers. In addition, we include the effects of salt concentration, osmosis, evaporation as modified by the lipid layer, and the polar portion of the lipid layer. Numerically solving the resulting model, we explore the conditions for tear film breakup and analyze the response of the system to changes in our parameters. Our studies indicate sufficiently fast peak values or sufficiently wide areas of evaporation promote TBU, as does diffusion of solutes. In addition, the Marangoni effect representing polar lipids dominates viscous dissipation from the non-polar lipid layer in the model.

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