

Abstract Submitted  
for the DFD06 Meeting of  
The American Physical Society

**Models for the Dynamics of the Human Tear Film** R.J. BRAUN,  
L.P. COOK, University of Delaware, P.E. KING-SMITH, Ohio State University —  
Every time one blinks, a tear film is left on the front of the eye to protect the  
cornea and to help provide a smooth optical surface, as well as other functions. We  
adopt the accepted view that the tear film layer contains a primarily aqueous layer,  
and we develop models for the formation and evolution of the aqueous layer over  
one or more blink cycles using lubrication theory. The models incorporate surface  
tension, viscosity, surfactant transport, Marangoni effects and slip on the cornea. A  
comparison with in vivo interferometry is made for a half blink and it is favorable.  
In two models and one set of conditions, the amount of lid closure required for the  
tear film to be completely restarted is found to be about  $7/8$  from considerations  
due solely to fluid dynamics; that is, if the eyelids close to about  $1/8$  of the fully  
open width, that is enough to fully refresh the tear film.

Richard Braun  
University of Delaware

Date submitted: 04 Aug 2006

Electronic form version 1.4