JAMES L. WINKLE COLLEGE OF PHARMACY
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SUMMER RESEARCH OPPORTUNITIES FOR UNDERGRADUATE WOMEN

APPLICATION DEADLINE: 03/01/2018

PROJECT TITLE: **Investigating interaction of skin proteins with surfactant mixtures**

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Project Description

Soap and body wash are the main compositions of interest, and we are perpetually interested in how surfactants interact with the skin. When surfactants clean the skin, they interact with the surface of the stratum corneum. One of the most consumer-relevant attributes for our products is the feel of the skin during rinsing of their wet skin, at which time the consumer is deciding if their skin is clean and whether it feels moisturized. Soap tends to make the skin feel â€˜draggyâ€™, synthetic surfactants vary, and moisturizing body washes can make the skin slippery when wet. In the past, we have generally treated this problem as a â€˜coatingâ€™ problem, since soaps can deposit crystals (Ca-Mg-soaps) onto the skin, body washes can deposit polymer-surfactant coacervates, and moisturizing body washes can deposit oils such as petrolatum onto skin.

However, recent observations have caused us to question a lubrication based model for skin feel. For one, we cannot explain the observation that consumers using water softeners complain about wet skin being slippery, using coatings and hydrodynamic lubrication theory. Additionally, many surfactants can be shown to produce differences in lubrication during rinse, in the absence of cationic polymer coacervates.

As the stratum corneum surface is exposed, surfactants are able to directly interact with the surface, i.e., cornified cells and whatever remains of membrane lipids. In general, we have treated skin properties as largely derived from the membrane lipids. The skin is relatively non-polar, for example, having a surface energy similar to what one would expect from alkyl hydrocarbon chain tails. Yet, more recently, a number of researchers have observed proteins on the stratum corneum surface using different techniques. The proteins may be hydrolyzed desmosome segments. If corneodesmosome

segments exist on the surface of the stratum corneum, they are likely to be tethered to the corneocytes at one end. We hypothesize these partially hydrolyzed protein segments may partially solubilize while remaining tethered on the skin surface, by interaction with aqueous surfactant micelles in a process also influenced by ion exchange and pH (body washes are generally neutral; soaps about pH 10.5). We suggest a project to study how proteins and/or protein films interact with surfactants and surfactant mixtures in the presence of electrolytes to render insoluble proteins, soluble. We suggest a level of work akin to developing a protein solubility assay, potentially not unlike some current methods used to screen surfactants for irritation potential.

The student will work closely with the PI from UC and will interact with scientists from P&G which will provide them exposure to industrial collaborations. The students is expected to have interest in cosmetic science, biology, physics and/or chemistry.