Research Theme
Infection & Immunity / Dermatology & Skin Biology

Research Project Title
Lipidomics of Keratinocytes-S. aureus Interactions – Elucidation of the Functional Roles of Lipids in Skin Health and Infections

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Project Description

The skin is the largest organ, serving as a physical barrier to protect the body from the external environment and assault by foreign organisms and toxic substances. It is colonized by a diverse milieu of microorganisms, most of which are harmless, and some are even beneficial to their hosts. Following injury of the skin, mechanisms are in place to ensure rapid recovery of the protective barrier to prevent water loss and opportunistic infections by infiltrating microbes. This includes extensive changes in lipid transport and metabolism. Indeed, lipids play critical roles in skin functions ranging from forming a hydrophobic permeability barrier to inflammatory responses associated with allergic reactions. The skin is able to produce an astonishingly wide variety of complex lipid structures unique to this organ. Manufacturers of cosmetics have in fact capitalized on the essential roles of lipids in their products to promote skin health.

Disruption of the delicate balance between host and microorganisms can result in skin disorders and/or infections. *Staphylococcus aureus* is a major cause of skin infections, and may underlie and aggravate atopic dermatitis, and cause toxic shock syndrome. In contrast, *S. epidermidis* is a commensal which plays important protective roles by directly producing or by stimulating our skin to produce antimicrobial peptides against pathogenic infections. The regulation of many virulence factors is mediated by environmental and nutritional status. In fact, all bacteria require carbon and energy for growth and replication and pathogenic bacteria, including *S. aureus*, are particularly clever with their abilities to derive these from the host organisms. However, little is known about lipid metabolism and functions during the skin-microbe interactions. We hypothesize that given the essential roles of lipids in skin health and biology, perturbation of lipid metabolism during pathogenic infections will impact on permeability as well as inflammatory responses and contribute to disease outcome.

In this project, we will combine high-end lipidomics approaches, keratinocyte-staphylococcal infection models, cell and molecular biology with the aims to scrutinize the roles of lipids in staphylococcal infections and skin health both *in vitro* and *in vivo*, in samples from human skin. We
will identify lipid mediators and pathways and perform cell-based functional assays, involving pharmacological intervention and genetic manipulation, as well as lipid reconstitution, to understand lipid functions and evaluate their relevance as therapeutics and/or aesthetics in skin health and diseases.

Contact Us

If you have questions regarding this project, please email the Principal Investigator.

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