Ackert Hall, Room 120
Wednesday, October 8, 2025
4:00 P.M.

Coffee and Cookies
Chalmers Hall, Room 168
3:45 P.M.

Biochemistry & Molecular Biophysics Seminar

Adapting a 3D-organotypic human skin model to model the tick-pathogen-skin interface

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Since dissemination from a tick bite to distant tissues is required to cause disease, there is a critical need for field-ready therapeutics that could be directly applied to a tick bite to kill any transmitted pathogens and greatly decrease the incidence of tick-borne disease. In the absence of a relevant cultured human skin model, the development of new therapeutic methods and targets to prevent tick-borne disease will remain limited to rodent models that have markedly different skin thickness and cellularity from humans. Thus, we have adapted a 3D-organotypic skin model that is composed of skin cells (HACAT keratinocytes) stratified on a base of collagen with embedded fibroblasts (NHDFs) that can be exposed to human blood through a porous membrane. We have demonstrated that *Ixodes scapularis* nymph-stage ticks readily attach to the surface of organotypic skin with a quarter of ticks becoming partially enlarged during the feeding period. We have also monitored growth of the Lyme Disease pathogen, *Borrelia burgdorferi,* under injection conditions mimicking primary infection from a tick bite and found that salivary gland extract greatly increased the ability of *Borrelia* to colonize organotypic skin, which is consistent with previous findings in human biopsies. We also mimicked secondary dissemination back into the skin from the bloodstream, and found that while the bacteria colonize the skin, they undergo cyclical periods of stress indicated by abnormal morphologies. In this case, we have found a role for dermal fibroblasts in limiting *B. burgdorferi* infection in the skin. Finally, we have introduced other cell types into the skin model to investigate the immune response (macrophages) and dissemination (vasculature) during early stages of infection. Together, these novel modifications to the human organotypic skin model will enable us to systematically investigate the host and bacterial factors that enable *B. burgdorferi* colonization of human skin.