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Presentation Title: Identifying Molecular Targets for Spatial Mosquito Repellent Design
Research Priority Area: Support Development of Vaccine or Other Methods

Abstract: The recent Zika outbreak in Florida has highlighted our state's vulnerability to mosquito-borne illness. Aedes mosquitoes are the principle vectors of dengue, chikungunya, and Zika of which Aedes aegypti is the most competent vector. The current tools we have to prevent mosquito transmission have been insufficient to stop the spread of these illnesses. Odors that keep mosquitoes away from people could break the cycle of disease transmission. Our goal is to make a life-saving perfume that can prevent mosquitoes from biting humans. DEET, an insect repellent developed by the USDA in collaboration with the U.S. military during World War II, is one of best repellents we currently have. DEET alternatives like picaridin, IR3535, oil of lemon eucalyptus, and PMD have subsequently been identified and approved for use by the Environmental Protection Agency (EPA). However, DEET and DEET alternatives have significant drawbacks that limit their usefulness such as its short-range spatial protection, the need for reapplication to skin at high concentrations, and the inability of the compound to be impregnated into clothing or bracelets. The development of new spatial repellents that will block mosquito attraction to humans are present a powerful tool to block the transmission of Zika. Although we have some understanding of how DEET works, little is known about DEET alternatives (picaridin, IR3535, oil of lemon eucalyptus, and PMD). Uncovering the mechanism of how these compounds repel mosquitoes can provide crucial insight that will guide new spatial repellent development. Our approach uses a new technique developed in mammals and Drosophila, Deorphanization of Receptors based on Expression Alteration of mRNA levels (DREAM), that our data shows can work robustly in mosquitoes. This is allowing us to comprehensively determine which Aedes aegypti olfactory receptors are activated by EPA-approved repellents in vivo by characterizing the mRNA levels of these receptors. The odor-responsive gene sets we will produce will provide insight into the molecular mechanism of mosquito avoidance behavior and a list of molecular targets for repellent odor design.