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Pheromone Perception: Structure and Function of Pheromone-Binding Protein

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ABSTRACT

The ability to respond to chemical stimuli is a fundamental behavior of all organisms. Lepidoptera male moths have an exquisitely sensitive olfactory system that is capable of perceiving airborne pheromone molecules released by females and responding to them over great distances. Pheromone binding proteins (PBPs) located in the antennae of male moths play an important role in olfaction. They are carrier proteins that pick up volatile hydrophobic pheromone molecules at high pH and transport them across the aqueous sensillar lymph releasing at low pH near the membrane-bound olfactory neuron. Unraveling the mysteries of pheromone binding and release controlled by changes in pH is critical not only to our understanding of insect olfaction but also for any future investment on control of the olfactory behavior of deleterious insects that are voracious agricultural pests of many important crops through pheromone based integrated pest management.

The mechanism of pheromone binding and release by pheromone-binding protein of the giant silk moth Antheraea polyphemus will be discussed. In the current model, the entry and exit of the odor molecule is proposed to be regulated by two gates located at opposite ends of the hydrophobic pocket of ApolPBP1. Two histidine residues (His70 and His95) at one end of the pocket serve as one gate while the C-terminus on the opposite end of the pocket serves as the other. The role of His70 and His95 in the release of the ligand at low pH and the role of the C-terminus of ApolPBP1 in ligand binding and release through mutagenesis and biophysical studies will be presented. Our investigation reveals that both His-gate and C-terminal gate of ApolPBP1 indeed play a critical role in the release of the pheromone molecule from the carrier protein near the olfactory neuron.

The details of the ligand binding and releasing conformations along with the models of pheromone uptake and release will be presented.

BIO:

Smita Mohanty received a PhD degree in Chemistry and conducted postdoctoral studies in Structural Biology at the University of Washington and in New York. She joined the faculty of State University of New York at Stony Brook, New York in 1999. She is currently in the Department of Chemistry at Oklahoma State University as an Associate Professor. Dr. Mohanty received the Presidential Early Career Award for Scientists & Engineers (PECASE) in 2000. She is an Executive Editor of the journal Biochemistry & Physiology; Editorial Board Member of the Journal of Metabolomics & System Biology and J. Sci. Med Chemistry. Her research interests encompass molecular biology, protein chemistry, structural biology, biophysics and computational chemistry. She takes a multidisciplinary approach to characterizing the structure, and function of both globular and membrane associated proteins involved in various diseases and disorders with the overall objective of understanding the molecular basis of function with a goal for exploiting these as new therapeutic targets to address the underlying diseases.