# The Molecular Genetics Of Olfaction and Host Selection in Disease Vector Mosquitoes

The Laboratory of LJ. Zwiebel
Department of Biological Sciences
Center for Molecular Neuroscience and Program in Developmental Biology
Vanderbilt University, Nashville TN, 37235 USA

The ability to sense and discriminate a large collection of chemical and visual cues is central for several behaviors of insects that act as vectors for the pathogens that are responsible for many important human diseases. In particular, olfaction plays a major role in host seeking and selection behaviors of blood feeding female anopheline mosquitoes. This group of mosquitoes includes non-vector species as well as the principal Afrotropical malaria vector species *Anopheles gambiae* whose strong preference for human hosts (anthropophily) is largely responsible for its high vectorial capacity. A long-term objective of our research is centered on an examination of the molecular genetics of the chemosensory system in anopheline and other mosquitoes and its role in determining anthropophilic host preference in malaria vector mosquitoes. Data will be discussed concerning the characterization of representatives of several families of genes that together make up essential elements of the peripheral chemosensory signal transduction cascades in *An. gambiae* and other vector mosquitoes. These include arrestins, G-proteins and serpentine receptor proteins associated with olfactory and gustatory pathways. Understanding of the olfactory system of the malaria vector mosquito, *An. gambiae*, could provide a better approach to control olfactory based human host (blood meal) preferences.

We have identifed and continue to characterize the complete repetiore of 79 olfactory receptor (OR) genes *An. gambiae*. Among these, AgOR7, the anopheline ortholog for a highly conserved subfamily of insect odorant receptors, is thought to play an important role in olfactory signal transduction. AgOR7 is expressed in most of the olfactory neurons in antenna, maxillary palp and the proboscis of female mosquitoes. Furthermore, RT-PCR analyses in this study indiate that several OR genes are also expressed in the proboscis, supporting the hypothesis that this appendage (together with the antennae and maxillary palps) plays a functional role in a subset of olfactory responses. We have used electrophysiology to characterize the olfactory responses from each T2 proboscis sensillum containing AgOR7 expressing neurons and will present data indicating that there are narrowly tuned olfactory reponses to human sweat compounds further suggestive that a restricted set of ORs are indeed functional in this appendage. Also, the central projection patterns of proboscis neurons reveals arborization to the ventral antennal lobes, which is the initial olfactory processing center in the insect brain. Taken together, these data strongly support the hypothesis that in addition to its primary role in gustatory chemosensory processes the proboscis is the site of an accessory olfactory pathway. It is tempting to speculate that this appendage could detect critical olfactory information from human skin at extremely close range that is critical in the terminal processes of mosquito blood feeding behaviors. We have also begun to explore the complexities of how olfactory information is encoded in this system at both molecular and neurological levels. With this information in-hand, we are now poised to undertake efforts for the design of novel anti-malarial programs that target chemosensory pathways and the behaviors they control in vector mosquitoes.

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