Bad news for mosquitoes: Study may lead to better traps, repellents

February 3 2010

Yale University researchers have found more than two dozen scent receptors in malaria-transmitting mosquitoes that detect compounds in human sweat, a finding that may help scientists to develop new ways to combat a disease that kills 1 million people annually.

These olfactory receptors in the mosquito Anopheles gambiae offer scientists potential new targets for repelling, confusing or attracting into traps the mosquitoes that spread a disease afflicting up to 500 million people across a broad swath of the world's tropical regions, according to authors of the article published online Feb. 3 in the journal *Nature*.

"The world desperately needs new ways of controlling these mosquitoes, ways that are effective, inexpensive, and environmentally friendly," said John Carlson, the Eugene Higgins Professor of Molecular, Cellular, and Developmental Biology at Yale and senior author of the study. "Some of these receptors could be excellent targets for controlling mosquito behavior."

While it has long been known that mosquitoes are attracted to human scents, just how the mosquito's olfactory system detects the different chemical elements of human odor has been unknown.

"Mosquitoes find us through their sense of smell, but we know very little about how they do this," Carlson said. "Here in the United States, mosquitoes are a source of annoyance, but in much of the world they're a source of death."

Carlson's lab identified the first insect odor receptors in 1999 in studies of the fruit fly. The Yale team then found an ingenious way to use the fruit fly to study how the mosquito olfactory system works: They used mutant flies that were missing an odor receptor. Under the leadership of Allison Carey, an M.D./Ph.D. candidate in Carlson's lab and lead author of the study, the researchers systematically activated genes of 72 mosquito odor receptors in fruit fly olfactory cells that lacked their own receptors. The engineered flies were then exposed to a battery of scent compounds, and the responses conferred by each receptor were analyzed. Over the course of the project, Carey recorded 27,000 electrical responses in the genetically engineered fly/mosquito olfactory system to the library of scents.

Particularly strong responses were recorded from 27 receptors - and most of these receptors responded to chemical compounds found in human sweat.

"We're now screening for compounds that interact with these receptors," Carlson said. "Compounds that jam these receptors could impair the ability of mosquitoes to find us. Compounds that excite some of these receptors could help lure mosquitoes into traps or repel them. The best lures or repellents may be cocktails of multiple compounds."

Carey says that more knowledge about mosquito behavior and odor reception will help develop more effective traps and repellents.

Provided by Yale University