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K-STATE RESEARCHERS CHARACTERIZE MOSQUITO GENES TO LEARN HOW INSECTS DEFEND AGAINST PARASITE THAT CAUSES MALARIA IN HUMANS; RESEARCH COULD BENEFIT DISEASE CONTROL

MANHATTAN -- By unraveling the mysteries that exist within the molecular composition of mosquitoes, a team of Kansas State University researchers is trying to discover how the insects survive a parasite that causes malaria in humans.

Kristin Michel, K-State assistant professor in the Division of Biology, has been leading studies involving Anopheles gambiae s.s. mosquitoes, which are the main contributing species to malaria transmission in Africa. Michel's research team's recent project involved characterizing genes specific to hemocytes, which are mosquito blood cells. The researchers were able to identify genes in the blood cells whose expression changed with malaria infection.

"This could be used for disease control, ultimately," Michel said. "On a more basic level, we want to understand how the immune system works and how it recognizes a parasite and limits the infection."

The research was published in the Proceedings of the National Academy of Sciences in December 2009. The other contributing K-State researchers are Chunju An, research associate in biochemistry, and Krista McKay, senior in microbiology and a 2006 graduate of Halstead High School.

Michel said the research emphasizes one part of the mosquito's immune system that defends the insect against the Plasmodium parasite, which causes malaria in humans. The project is a step toward characterization of this branch of immunity.

"If you think about the immune system, it gobbles up things like bacteria," Michel said. "Insects have cells that help the body to ultimately kill the bacteria. However, we do not know how these cells contribute to getting rid of parasites."

While these blood cells are essential to the mosquito's cellular immune response, little is known about their molecular composition. For the study, the researchers collected blood cells from the

mosquito species and then used microarrays to identify the cells' genes and how they are related to other insect species.

They also collected blood cells from mosquitoes that were infected with the parasite and identified genes whose expression levels changed with malaria infection.

"It could be possible through gene manipulation to create mosquitoes unable to transmit malaria," McKay said. "This list of genes could help researchers develop new prevention strategies."

As an undergraduate student, McKay's role in the project included identifying the functions of the genes according to the microarray experiments. She became involved with the project through the Kansas **Institutional Development Award** Network of Biomedical Research Excellence when she received an undergraduate research scholarship as a sophomore.

Through her research experience, McKay has learned about various technologies and techniques used in experiments that will be beneficial for future research work. She plans to pursue graduate studies in food microbiology and would like to have a career conducting research at a government agency or a private company studying foodborne illnesses.

The researchers are continuing the study and looking comprehensively at the blood cells and how they respond to the parasite. Michel said the mosquito produces many molecules that either help or prevent parasite infection. The mosquito's cells are an important factory for these molecules, she said. The researchers are trying to discover the factors that kill the parasite within the mosquito.

The K-State group collaborated with several researchers from the faculty of natural sciences at Imperial College London in the division of cell and molecular biology: Sofia Pinto, Fabrizio Lombardo, Anastasios Koutsos, Robert Waterhouse, Chandra Ramakrishnan and Fotis Kafatos.

The project has been ongoing since 2004. The research was funded by grants from the Kansas Institutional Development Award Network of Biomedical Research Excellence, the Wellcome Trust and the National Institute of Allergy and Infectious Diseases.