

Revealed -- Mosquito genes that could be controlling the spread of killer viruses

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The genes that make up the immune system of the *Aedes aegypti* mosquito which transmits deadly viral diseases to humans have been identified in new research out today in *Science*.

The immune system of this mosquito is of great importance as scientists believe it plays a key role in controlling the transmission of viruses that cause yellow and dengue fevers – diseases that infect over 50 million people worldwide every year.

This study is the first of its kind on the newly-sequenced genome of the *Aedes aegypti* mosquito, which is also published in this week's *Science*.

The researchers identified over 350 genes which are involved in the *Aedes* mosquito's immune system, and discovered that they evolve much faster than the rest of the genes in the genome. Identifying which of these key genes are implicated in the transmission of viral diseases is an area of future research that could lead to new ways of combating these diseases. One possibility would be to affect the activity of the genes and therefore help the mosquitoes fight off the viruses more effectively, preventing transmission to humans.

Imperial College scientists participating in this study established previously that other mosquitoes do have a robust immune system that can either allow or block transmission of malaria parasites. Further research will be needed to ascertain whether some of the newly discovered genes in *Aedes* may provide a similar defence mechanism

that can fight the disease viruses.

Dr George Christophides of Imperial's Division of Cell and Molecular Biology, senior author on the paper explains: "Our study has revealed the genetic 'landscape' made by parts of this mosquito's newly-sequenced genome which are involved with immunity. By working to understand as much as possible about these genes, and the way they interact with specific pathogens, we hope to gain a more complete understanding of the mechanisms by which a pathogen either survives inside the insect body, or is killed by the insect's defences."

The international research team, led by Imperial PhD student Robert Waterhouse, focused on comparing the immunity genes of the *Aedes* mosquito with similar groups of genes in the harmless fruit fly and the *Anopheles* mosquito that transmits malaria. When comparing the two different mosquitoes, the scientists found some similarities in the genes controlling their respective immune systems, but also numerous differences. The team aims to discover which of these genetic differences could explain why one type of mosquito transmits dengue and yellow fevers, while the other transmits malaria. Beyond the present descriptive work, functional studies will be needed to clarify exactly how this happens.

"This study made us realise that the immune systems of insects are not static but evolve and differentiate rapidly, most likely in response to the different pathogens which each insect species encounters", says Dr Christophides.

Professor Fotis Kafatos, senior researcher of Imperial's immunogenomics lab and co-author of the paper, explains the significance of their study, saying: "Understanding the genetics behind pathogen/immune system interactions in disease vector mosquitoes may help us understand why, for example, some types of mosquitoes can

transmit a particular human pathogen while others cannot. If those that cannot have evolved an effective immune system that fights off the pathogen, we may be able to use this knowledge to enhance specific reactions of the immune systems in other mosquitoes to control the spread of the disease.”

Source: Imperial College London

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