Video Article

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Abstract

Protocol

This issue of JoVE highlights the advanced biological research directed at the eradication of mosquito-borne diseases like dengue fever and malaria, which claim 1-3 million lives each year. In the case of malaria, novel genetics-based control approaches are employed to develop mosquito populations that are refractory to the parasite and which may prove to be instrumental in containing and eradicating the disease. Particular emphasis is put on the population replacement strategy, which involves the release of genetically modified mosquitoes into the wild in an effort to control dengue and malaria transmission.

Video-articles in this issue demonstrate a variety of advanced research approaches in mosquito biology, from gene delivery techniques to mathematical modeling of gene flow in wild mosquito populations. The Dimopoulos group at Johns Hopkins presents molecular level assays aimed at determining infection efficiencies of mosquitoes with dengue virus and Plasmodium falciparum. These experiments are employed to identify refractory genes - genes conferring resistance of these pathogens. The James lab at the University of California, Irvine demonstrates approaches for producing transgenic mosquitoes carrying refractory genes. In a candid interview, Anthony James explains the potential for using these transgenic mosquitoes to control the wild vector population. The Rasgon group at the Johns Hopkins describes how the bacterium Wolbachia pipientis can be used to drive refractory genes through vector populations by genetic hitchhiking. Finally, Charles Taylor's group at the University of California, Los Angeles demonstrates the application of mathematical modeling for evaluating the effectiveness of the population replacement strategy.

Every 15 seconds a child dies of malaria. Recent breakthroughs in genetic engineering now allow focusing on the potentially weak link in transmission of vector-borne diseases: the vector itself. The development of refractory mosquito populations is a promising approach to conquer the devastating disease that has severe consequences for the affected individual and remains a heavy socio-economic burden for society as a whole.