Robotic Microinjection of Embryos for Producing Transgenic Mosquitoes

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The goal of this project was to assist malaria research by expediting the process of producing transgenic mosquitoes. In this project, I developed and tested a novel automated instrument for injecting mosquito embryos, which I harvested from artificially created habitats. The robotic microinjection system is designed to precisely maneuver a pipette tip, having a diameter of roughly 10 microns, to the end of a mosquito embryo, having a width of about 150 microns. The system features electronic translation stages for moving the pipette, a novel rotating shaft for mounting the eggs, and a microscope camera for imaging the eggs. Modified open source AI object detection software detects the eggs, and code I wrote determines the endpoint of the detected eggs and causes the translation stages to move the pipette to the embryos. Mounting the eggs on a curved rotating shaft allows the pipette to access individual embryos without other embryos blocking the path of the pipette to the intended embryo. This design avoids manually lining-up the embryos in a row, which is the current approach employed by researchers. Another novel innovation was the use of UV light to assist in detecting larvae in the artificially created habitats. UV light appears to cause the dark water in the habitats to fluoresce, enabling high contrast visualization of the larvae. Habitats with larvae had eggs that could be harvested and used to test the instrument. The instrument detected mosquito embryos only 27% of the time. However, once the embryos were detected, the system moved the pipette to the embryos 100% of the time. These preliminary results indicate that a robotic microinjection system is likely viable, but the device needs refinement to be a useful research tool.

Awards Won:

Third Award of $1,000