# An Early Warning System for Zika Virus in Mosquito Populations Based on Real-Time Field Detection of Viral RNA in Mosquito Saliva

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The Zika virus (ZIKV) epidemic is an urgent global health crisis. While RT-PCR is the gold standard for detecting ZIKV, a lengthy turnaround time (2-4 weeks) and laboratory data analysis can lead to infection of additional individuals, especially in areas with limited infrastructure. This study describes the development of an early warning system for ZIKV in mosquito populations via real-time detection of the virus in mosquito saliva without further lab analysis, allowing for quarantine measures while PCR tests are run. Designed as an all-in-one unit, a low-cost mosquito trap was constructed that effectively collects mosquito saliva and used to demonstrate that virus would be deposited into the trap in a field scenario. Saliva from live mosquitoes deposited into a 10% sucrose foodsource was detected using a bioluminescence method to follow the activity of apyrase, an enzyme in mosquito saliva. To detect ZIKV in the trap without human interaction, a colorimetric gold nanoparticle (AuNP) assay specific to ZIKV was devised and incorporated in the foodsource. Aggregation of these DNAzyme-functionalized AuNPs is only observed in the presence of ZIKV RNA and is temperature-independent. At ZIKV RNA concentrations 10 times less than that contained in mosquito saliva, positive virus detection is easily discernible, even by non-experts, as a red-to-colorless change in situ within 15 minutes. As an early warning system (trap-AuNP assay combined) placed in the field, the rapid detection of ZIKV-infected mosquitoes allows immediate quarantining of the vicinity until further tests are conducted, thus preventing the spread of virus to local residents.

**Awards Won:**

Intel ISEF Best of Category Award of $5,000