A NOVEL BIOSILICA-BASED DETECTION SYSTEM FOR (RE)-EMERGING ARBOVIRAL INFECTIOUS DISEASES

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For several decades, vector-borne pathogens have been responsible for severe outbreaks and represented more than 17% of (re)-emerging infectious diseases. ZIKV the causative agent of Zika belongs to the Flaviviridae family and is an example of an arbovirus that is transmitted by Aedes aegypti and Aedes albopictus mosquitoes. Since its discovery in 1947 in Uganda, ZIKV caused several outbreaks which have beenamong the worst cases, with the most recent one in Brazil. Unfortunately vaccine or specific treatments are not available, and the best way to fight against ZIKV remains vector control essentially by the over spraying of insecticides. Because this method causes some toxicity effects for the environment and insecticide (multi)-resistance into vectors, limiting spraying of insecticides only to concerned areas remains a priority. In this context, we investigated the development of an innovative device for the mapping of ZIKV-infected mosquitoes. Detection of ZIKV, but also other arboviruses, could be achieved by using a customizable detection patch that can point outmosquito-borne pathogens directly into their vector, upstream of the identification of human infected cases. This patch when coupled with a human pheromones-based mosquito trapping system, and a mapping software, isa strongly needed tool which will allow us to perform a high resolution surveillance of arbovirus circulation in order to focus our attentionon infectedregions only. As a consequence, rational use of insecticides and prevention of outbreakscan be implemented where infected mosquitoes are proliferating.In this work, we report the development of a synthetic biology-based composite arbovirus-detection patch. We took advantage of the biodegradability and inert properties of cellulose as the basis for the physical support. Moreover, by using a multifunctional fusion protein that is theoretically able to rigidify and functionalize the cellulose layer, we demonstrated a simple way to create a novel, user-friendly, safe, and low-cost immuno-detection system. This chip could potentially detect any arboviral proteins in mosquitoes. In preliminary studies we have demonstrated the ability of this protein to bind to cellulose and to bio-condense silicic acid into silica in solution. In addition, this assay isable to single-out the envelope protein of Chikungunya virus among mosquito proteins using specific antibodies. We consider these preliminary results as being very promising since the project was just awarded the “Best

Diagnostic Project" in the 2016 international genetically engineered machine competition.