Temperature-Independent, Portable, and Rapid Field Detection of Ebola via a Silk-Derived Lateral-Flow System

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Up to 90% of Ebola victims will die without early diagnosis and medical intervention, which can reduce fatalities by 50% and are critical to preventing future epidemics. Current detection methods are expensive, time-consuming and utilize complex instrumentation and chemicals that require uninterrupted refrigeration. Successfully maintaining the reagent's “cold-chain” from laboratory to point of use is highly problematic in regions with poor infrastructure, where Ebola is most common. This research sought to devise a rapid, simple and inexpensive Ebola detection platform that can be stored and transported without refrigeration. To begin, current Ebola ELISA reagents were embedded in silk fibroin, which possesses stabilizing properties, allowing storage of otherwise refrigerated reagents at room temperature. To confirm ELISA colorimetric detection of Ebola after prolonged, non-refrigerated storage of the kit's reagents, the Ebola ELISA was conducted in a 96-wellplate format (A450nm) at 0-7days from initial mixing and dilutions. Results indicate Ebola ELISA detection is viable in water dilutions only on the day of mixing. For silk-embedded reagents, successful detection was realized for up to one week of RoomTemp-storage. Silk-film embedded Ebola ELISA reagents were used to construct a four-channel, paper-based, fluidic detection card, with colorimetric reagents positioned to create timed, visible detection of Ebola antigens. In this new device, that is stable and stored at room temperature, 30µl drops of water were used to dissolve silk-embedded reagents, initiating a timed-flow towards a center detection zone, where a positive (colored) result confirmed the presence of 500pg/ml Ebola(+)control antigens in 30min, at a cost of $25.

Awards Won:
First Award of $5,000