Stanford University

Rapid Label-Free Pathogen Diagnostic Device

Rapid and accurate detection of respiratory syncytial virus (RSV), which is one of the leading causes of hospitalizations of infants and young children worldwide, is needed to improve patient care and outcome. Available tests can be expensive, lengthy, and complicated, making them unattractive for use in developing countries and in hospitals with low budgets. This proposed work, carried out in collaboration between the Stanford University and Loughborough University teams, describes a novel, low-cost, on-line device that can quickly and accurately detect RSV in solutions without the need for expensive equipment or extensive expertise for early initiation of appropriate treatment and limit antimicrobial resistance. Our device uses laboratory-created materials that can directly and specifically capture a targeted pathogen (i.e., bacterium or virus) in a lock-and-key approach on a quartz crystal oscillator. Those that do not fit into the "lock" are captured very loosely or not at all. Once captured, the pathogen is "sensed" by a novel nonlinear acoustic technique that looks at differences in generated frequencies. Binding of the targeted pathogen causes a significant change in frequency in the acoustic spectrum of the oscillator, signaling the presence of the virus in the sample, much like an alarm detects an intruder. Those that fit tightly into the material give off a large frequency signal and those that do not fit well give little to no signal at all. Initial evaluation of our device for the detection of a variety of target bacteria and viruses shows the feasibility of this device for quick and accurate identification of a targeted pathogen. Our preliminary results suggest that our device can provide a significant solution to the need for more quick and accurate testing of respiratory secretions for the detection and identification of RSV early in its infection. It is low-cost and easy to operate for point-of-care use to improve patient care and outcome worldwide.