

INNOVATING CROSS-DOMAIN SOLUTIONS TO DETECT EMERGING BIOLOGICAL THREATS

Photonic Integrated Circuits And Protein Catalyzed Capture Agents As A Multiplexed, Heat And Shelf Stable Biosensor For Biological Targets

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The ability to sense proteins is become of vital importance not only to health, but to detecting unknown pathogens such as viruses and bacteria. Protein monitoring in operational environments is a challenge since these areas can be remote, diverse (air, land, sea), and lack basic resources such as electricity. Currently the majority of SARS-CoV-2 tests target their antigen and spike proteins. At-home tests require a sample over a threshold in order to show a positive response where the patients are already expressing symptoms or are contagious. Although the tests can be quick, they are prone to false positives/negatives and have a limited shelf stability. Bacterial tests primarily require culture of specimens which present a time to data problem in accessing illness and spread. These proteins are inherently difficult to sense since reliable tests require a cold-chain, dedicated lab space with complex tools and specialized staff. Development of a continuous monitoring sensor for viral and bacterial proteins could provide real-time information with impacts in health, human performance and provide the ability to detect a pathogen before symptoms arise. Here we show Protein Catalyzed Capture (PCC) peptides integrated on Photonic Integrate Circuit (PIC) microring resonator (MRR) as an optical based biomarker sensor with heat and shelf stability for the continuous monitoring of two proteins (streptavidin, interlukin-6) in serum down to attomolar(10^{-18}) levels without the necessity of a cold chain. PCCs act as synthetic antibodies with tailorable sensitivity, high heat resistance and can be tailored for a protein pathogen of interest. PICs have low size, weight, power, cost (Swap-C) and are scalable for mass manufacturing. Together PCCs and PICs build on each other to create a fieldable continuous sensing platform capable of monitoring proteins for the early-detection of multiple low concentration pathogens at once.