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REAL-TIME OPTICAL BIOSENSORS FOR IN VIVO DETECTION

Researchers at Stanford and the Chan Zuckerberg Biohub have developed a platform for real-time and continuous detection of biomolecules in vivo.

The development of technologies that can monitor circulating biomolecules in vivo, such as continuous glucose monitors, have transformed modern medicine. However, existing biosensor technology for continuous measurement of specific biomolecules in vivo are limited to analytes such as glucose, lactate and blood oxygen. Furthermore, existing electrochemical biosensor technologies lack the sensitivity to measure important analytes in low concentrations. The development of a general and versatile system to continuously, specifically and simultaneously measure circulating biomolecules in vivo would be a notable biomedical advancement.

Stage of Research
The inventors have developed a platform for the optical detection of biomolecules in vivo. Their system, which uses optical waveguides with attached probes for target molecular detection, can be used for real-time in vivo monitoring of molecules by measuring changes of the optical signals over time. The system is versatile and allows for real-time and specific detection of biomolecules, alone or simultaneously, in biological samples. For real-time measurements, the inventors leveraged their expertise in aptamer technology to convert non-natural aptamers into structure-switching detection molecules which change molecular confirmation upon binding to target analytes. Aptamer conformational switching generates a change in the fluorescence signal that is detected by the optical waveguide. The inventors apply their optical detection system to demonstrate the first instance of endogenous serotonin release in live brain slices in real-time.

Applications

- Continuously measure circulating biomolecules in vivo, such as: proteins, small molecules and other biomolecules
- Diabetes management via simultaneous glucose and insulin detection and monitoring
- Measurement of dopamine and serotonin release with improved sensitivity and photostability

Advantages

- Optical biosensors have greater sensitivity and spatiotemporal resolution compared to electrochemical biosensor technologies
- In vivo measurements with nanomolar sensitivity and sub-second temporal resolution

Patents

- Published Application: 20210372929
- Published Application: WO2020086764
- Published Application: 20240201089
- Issued: 11,953,441 (USA)

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