Washington University in St. Louis
Office of Technology Management

ENCAPSULATION TO PROTECT DETECTION ANTIBODIES IN IMPLANTABLE AND WEARABLE BIOSENSORS

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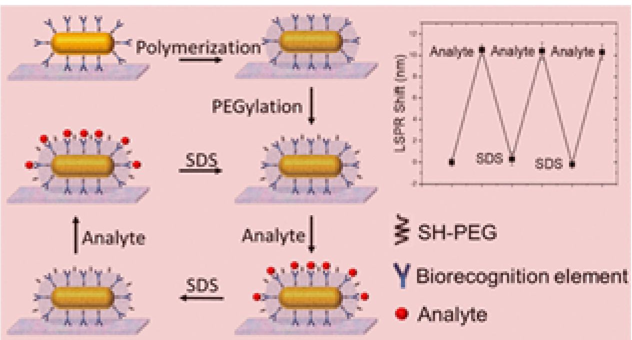
Technology Description

An interdisciplinary team of researchers at Washington University have developed a universal system designed to extend the lifetime of implantable and wearable biosensors by protecting detection antibodies from harsh conditions and enabling a refreshing process to release bound biomarkers.

Implantable and wearable biosensors have the potential to continuously monitor biomarkers for early or presymptomatic diagnosis of health conditions. However, it is difficult to use them over an extended time because the antibodies used to detect those biomarker become irreversibly saturated with analytes and can't detect further changes. In addition, the antibodies can lose their biorecognition ability when they are exposed to harsh conditions. This technology addresses these issues by encapsulating the antibodies with an organosilica polymer that protects them against harsh conditions, including a chemical treatment that releases bound biomarkers. With this universal system, the antibodies on the biosensor can be refreshed on demand without compromising functionality. By providing remarkable stability over multiple capture and release cycles, this method could expand the use of wearable and implantable biosensors for continuous monitoring of protein biomarkers over long durations.



Schematic of organosilica polymer preservation *– The antibody-covered nanostructure is encapsulated with polymer and then PEGylated. Target analytes bind to the antibodies and are detected through LSPR (localized surface plasmon resonance). An SDS refreshing step releases the target analyte, leaving the antibody available for another capture cycle. The process can be repeated through multiple cycles without compromising sensitivity or specificity.*

Related Technologies: The Soft Nanomaterials Laboratory at Washington University has developed additional technologies related to diagnostics and plasmonic biosensors:

NEED TO ADD TECHNOLOGIES HERE

Stage of Research

The inventors used a plasmonic nanostructure transduction platform with two model analytes (anti-IgG and neutrophil gelatinase-associated lipocalin, “NGAL”) to demonstrate the proof of concept that organosilica polymer encapsulation preserved antibody recognition.

Applications

- **Implantable and wearable protein biosensors** - encapsulating antibodies or other detection molecules to withstand harsh conditions or refreshing cycles

Key Advantages

- **Long-term monitoring:**
  - detection molecules protected during operation
  - simple aqueous refreshing step enables multiple capture/release cycles without compromising sensitivity or specificity
- **Facile and universal method -** thickness of polymer layer can be controlled to determine balance between preserving stability and leaving the antibody binding sites available for antigen capture

Publication: Gupta, R., Luan, J., Chakrabartty, S., Scheller, E. L., Morrissey, J. J., & Singamaneni, S. (2020). Refeshable Nanobiosensor based on Organosilica Encapsulation of Biorecognition Elements. *ACS Applied Materials & Interfaces.*

Patent: Application pending