E-Nose: A Nanowire Biosensor with Olfactory Proteins

Tech ID: 33564 / UC Case 2023-766-0

BRIEF DESCRIPTION

This e-nose sensor applies odorant receptor proteins fused to ion channels within a lipid bilayer, combined with semiconducting materials, to detect the binding of target molecules through changes in electrical conductance. Designed for sensitivity at the molecular level, it can identify a wide range of substances by mimicking the olfactory capabilities of living organisms.

SUGGESTED USES

·Defense and Security: Chemical weapons and IED detection.

·Manufacturing: Process control in industries requiring precise chemical monitoring.

·Environmental Monitoring: Detection of pollutants and hazardous materials in air or fluids.

·Healthcare: Diagnosis and monitoring based on the chemical analysis of biological fluids.

·Agriculture: Monitoring of soil and crop health through chemical sensing.

·Consumer Electronics: Integration into smart systems for home or workplace environmental quality control.

FEATURES/BENEFITS

·High sensitivity and specificity for detecting single molecule binding events.

·Capability to detect a wide array of target molecules, from TNT to aromatic compounds.

·Potential for multiplex detection through integration of different odorant receptors.

·Utilizes advanced materials, including carbon nanotubes and graphene, for enhanced performance.

·Can be adapted for both air and fluid samples, broadening application scope.

·Electronic integration allows for development of massively parallel e-nose systems.

TECHNOLOGY DESCRIPTION

Biosensors are well known and used in a number of applications. These devices operate by altering the current/voltage response of the FET when a target analyte binds to a capture agent on the FET surface. However, conventional biosensors current biosensors lack the ability to detect the presence of extremely low concentrations of target analytes. One class of biosensors uses an odorant receptor membrane protein to detect the presence of a target analyte. Here, an e-nose sensor is disclosed that utilizes odorant receptors a source electrode, a drain electrode, and a semiconducting region that connects or electrically couples the source and drain electrodes. A lipid bilayer is disposed on or adjacent to the semiconducting region and includes an odorant receptor protein that is coupled or fused to an ion channel protein. The semiconducting region changes its electrical conductance in response to the presence of ions adjacent to the semiconducting region that enter in response to binding of a target molecule (e.g., odorant) to the odorant receptor protein. The sensor is able to detect the binding of a single target molecule. Because this sensor is electronic it could

CONTACT

Edward Hsieh
hsiehe5@uci.edu
tel: 949-824-8428.

INVENTORS

» Burke, Peter J.

OTHER INFORMATION

CATEGORIZED AS

» **Sensors & Instrumentation**
» Biosensors
» Environmental Sensors
» Other

RELATED CASES

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be integrated in the future into a massively parallel e-nose system with signal recognition based on hundreds of different odorant receptor sensors integrated onto one chip. The sensor may be used to detect the presence of target molecules present in air or it may be used to detect target molecules present in a fluid (e.g., a biological fluid or environmental fluid sample).

PATENT STATUS

Patent Pending

STATE OF DEVELOPMENT

Conceptual

RELATED MATERIALS

» "Nanowire biosensors with olfactory proteins: towards a genuine electronic nose with single molecule sensitivity and high selectivity." Sangjun Noh et al 2023 Nanotechnology 34 465502. DOI 10.1088/1361-6528/acebf3 - 08/29/2023

OTHER INFORMATION

Provisional patent filed

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Microfluidic Device for Mitochondrial Membrane Potential Measurement
- In Vivo RFID Chip

UCI Beall Applied Innovation

5270 California Avenue / Irvine,CA 92697-7700 / Tel: 949.824.2683