Rapid and Sensitive Detection of Microbial RNA directly from Blood Samples by Electrical Biosensors

Tech ID: 34146 / UC Case 2016-200-0

ABSTRACT

Researchers at the University of California, Davis have developed a biosensor technology for rapid, sensitive detection, purification, and identification of nucleic acids in complex biological fluids.

FULL DESCRIPTION

This technology introduces a novel biosensor platform utilizing a two-stage molecular-based approach for the detection, purification, and identification of DNA and RNA biomarkers in complex biological samples. The first stage employs electrochemical detection of DNA:RNA hybridization within a tunable nanoporous electrode for screening specific nucleic acid-based biomarkers and facilitating the removal of complex media constituents. The second stage leverages single-molecule conductance measurements for identifying purified specific hybrids, offering strain-level information critical for diagnosing conditions like sepsis and detecting antimicrobial resistance.

APPLICATIONS

- Diagnostic assays for rapid identification of pathogens in clinical settings, particularly for urgent conditions like sepsis.
- Point-of-care diagnostic tools for field applications in epidemic and pandemic response.
- Food safety and environmental monitoring for detection of microbial contaminants.
- Research tools for studying microbial resistance and pathogen evolution.

FEATURES/BENEFITS

- Enables rapid and sensitive detection of pathogens directly from small volumes of biological samples without prior nucleic acid amplification.
- Utilizes nanoporous metal electrodes for selective transport and purification of nucleic acids, significantly reducing false positives and negatives.
- Provides strain-level identification of pathogens, crucial for effective treatment decisions.
- Capable of identifying anti-microbial resistant strains, aiding in the fight against antibiotic resistance.
- Supports multiplexing for simultaneous detection of multiple targets, enhancing diagnostic capabilities.
- Integrates seamlessly with microfluidics and electronic systems for a complete sample-in-answer-out platform.

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OTHER INFORMATION

KEYWORDS

biosensor, diagnostics, DNA, electrochemical detection, nanoporous metal, nucleic acids, pathogen identification, RNA, sepsis, single-molecule conductance

CATEGORIZED AS

- **Biotechnology**
  - Other
- **Medical**
  - Diagnostics

- Overcomes the limitations of traditional pathogen detection methods, such as long turnaround times and the need for large sample volumes.
- Eliminates the necessity for prior nucleic acid purification, streamlining the diagnostic process.
- Addresses the challenge of detecting pathogens in complex biological samples with high sensitivity and specificity.
- Reduces the risk of sepsis-related mortalities by enabling quicker, more accurate pathogen identification.

- **Nanotechnology**
  - Materials
- **Sensors & Instrumentation**
  - Biosensors

RELATED CASES

2016-200-0

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,209,383	12/28/2021	2016-200

Additional Patent Pending

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- On-Chip Platform for Single-Molecule Electrical Conductance Measurements
- A Combined Raman/Single-Molecule Junction System For Chemical/Biological Analysis
- Broadband Light Emission with Hyperbolic Material
- DNA-based, Read-Only Memory (ROM) for Data Storage Applications
- Hybrid Electromechanical Metamaterials for Optical and Electrical Devices
- RNA-based, Amplification-free, Microbial Identification using Nano-Enabled Electronic Detection

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