Ultrasensitive, Ion Channel-Based Sensors

Tech ID: 19190 / UC Case 2008-006-0

BACKGROUND

Detection and quantification at the level of single molecules is the ultimate goal of analytical assays. This sensitive, platform technology could transform diverse fields, from environmental monitoring and medical diagnostics to the fundamental studies of chemical and biochemical processes. The early potential of synthetic, ion channel-forming peptides was has not been realized; one factor of many has been the inability to translate the technology to low cost, large scale production of stable and portable devices. The absence of generalized modalities for sensing a broad range of analytes left few incentives to clear the hurdles.

TECHNOLOGY DESCRIPTION

UC San Diego researchers developed proprietary compositions of matter and methods for synthesizing exquisitely sensitive, ion channel-based nanosensors. Two different synthetic building blocks give ready access to a wide range of ion channel-based sensors that respond to specific and tailored external stimuli. These novel ion channels are extremely stable and the approach has been validated by the detection of selected chemical transformations, protein-ligand interactions, and enzymatic reactions. The nanoscale characteristics of these probes enable the development of highly sensitive assays in a low cost, portable format and the ability to design miniaturized devices may also enable the development of parallel assays in a high density platform.

ADVANTAGES

Ion channel-forming peptides are particularly attractive as a practical, molecular platform for development of nanoprobes. Advantages include their:

- Ability to sense a wide variety of external factors, including the presence of ligand-binding proteins, chemically and biochemically reactive agents, light, pH or electrolytes.
- Availability from commercial inexpensive sources and their amenability to large scale production.
- Spontaneous, self-incorporation into membranes, i.e., direct dissolution in aqueous solution vs. reconstitution into bilayers by proteoliposome fusion.
- Compatibility with user-friendly chemistry, such as “click” chemistry.
- Quantized conductance properties that simplify interpretation of the signal.
- Potential to customize derivatives with distinct conductance properties for specific sensing applications.
- High sensitivity based on amplification of ion flux through a single pore plus low background signal from non-ionic or colored molecules, which make their detection orthogonal and complimentary to existing optical detection platforms.

STATE OF DEVELOPMENT

A robust and well-characterized, proprietary, synthetic method has been used to generate ultra-sensitive sensors. Two of these ion channel-based building blocks (carrying reactive amine and azide functionalities) have been modified by versatile “click” reactions to yield sensors that:

- Respond to specific, programmed wavelengths of light.
- Detect chemically reactive analytes and potential biowarfare agents in solution.
- Probe the activity of membrane active enzymes.
- Quantify the binding and activity of specific proteins in solution at pM concentrations.

INTELLECTUAL PROPERTY INFO

See issued patent, below, for "Novel Ion Channel-Forming Peptides."

RELATED MATERIALS

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OTHER INFORMATION

KEYWORDS

nano-sensor, nanosensor, Gramicidin, gA, platform, new chemical entity, NCE, composition, clean technology, environmental, monitor, diagnosis, redox, light detection, click chemistry, detector, click, protein-ligand, enzyme

CATEGORIZED AS

- **Medical**
  - Devices
  - Diagnostics
  - New Chemical Entities, Drug Leads
- **Nanotechnology**
  - NanoBio
- **Research Tools**
  - Other

RELATED CASES

2008-006-0

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PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	8,586,369	11/19/2013	2008-006

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Lead Compounds for Diagnosis and Therapy of Alzheimer's Disease
- Fluorescent Amyloid Binding Agents for Diagnosis of Alzheimer's Disease
- pH-"Tunable" Nano-Particle Drug Delivery System

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