Enzyme-Logic Biosensing for Rapid Diagnostics

Tech ID: 20773 / UC Case 2009-299-0

BACKGROUND

Enzyme-based logic gates and their networks are recent developments in the field of biochemical information processing or biocomputing. Chemical logic gates mimic Boolean logic operations and are composed of chemical systems where the input and output signals are represented by concentrations of reactants and products, respectively. In particular, enzyme-based logic gates perform enzyme-biocatalyzed reactions resembling properties of Boolean logic systems.

TECHNOLOGY DESCRIPTION

UC San Diego researchers have developed biochemical logic methods and systems for rapid, high-fidelity diagnostics. The invention employs multiple markers as inputs to biochemical logic gates (e.g., “AND” and “XOR”) to trigger a cascade of enzymatic reactions and thus compute a final, digital answer regarding a patient’s physiological condition (“YES” or “NO”). Further, in the invention, biochemical signals logically processed by enzymes can be coupled with other sensing elements, e.g., electronic transducers operating as multi-signal responsive biosensors, or nano-structured signal-responsive materials operating as chemically triggered actuators. In one embodiment, the invention uses biomarkers for brain injury, trauma, shock, fatigue, etc., as inputs for physiological information biocomputing to facilitate rapid and accurate analysis, decision-making, and therapeutic intervention in the case of injured soldiers or accident victims. In another embodiment, the invention provides a sensor system for on-the-spot monitoring of multiple cardiac markers to allow fast and reliable detection of heart-attack symptoms, particularly identifying myocardial injury, independently of chest discomfort or other common warning signs. Proof of concept has been achieved for the invention’s enzyme-reaction processing of biochemical signals at their physiologically relevant concentrations. The invention also provides for a drug-delivery feedback-loop coupled with the diagnostic signal output.

INTELLECTUAL PROPERTY INFO

This technology has a patent pending and is available for licensing and/or sponsorship.

RELATED MATERIALS

- “Field-Hospital-on-a-Chip Project Awarded to NanoEngineer from UC San Diego”
- “Hospital-on-a-Chip Targets Battlefield”

RELATED CASES

See also related case SD2010-291 “Textile-Based Printable Electrodes for Electrochemical Sensing”

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OTHER INFORMATION

KEYWORDS

biocomputing, biochemical information processing, enzyme logic, biosensing, diagnostics, injury biomarkers, cardiac markers, battlefield injury, trauma, military medicine, emergency medicine

CATEGORIZED AS

- **Biotechnology**
  - Other
- **Medical**
  - Devices
  - Diagnostics
- **Nanotechnology**
  - Electronics
  - NanoBio
  - Tools and Devices
- **Sensors & Instrumentation**
  - Biosensors

RELATED CASES

2009-299-0, 2010-291-1, 2010-291-2

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