Methods and Systems for Raman Spectroscopy Based Detection of Blood Analytes in the Tympanic Membrane Vasculature
Technology #17459

Applications

This invention presents methods and systems for designing and building miniaturized Raman spectroscopic systems for detection of various bioanalytes, including blood glucose from the middle ear vasculature.

Problem Addressed

Raman spectroscopy has been successfully employed to detect molecular species embedded in complex biological samples due to its inherent selectivity, multiplexed capabilities and simple sample preparation. While Raman spectroscopy provides a powerful tool for non-invasive, real-time and multiplexed diagnostics of biological samples, the confounding signal from the tissue fluorescence and spectral shape alteration due to turbidity has prevented the widespread usage of Raman spectroscopy as a diagnostic tool in clinical and the point-of-care settings. The ideal anatomic site should have a thin layer of epidermis, low pigmentation and a substantially high distribution of blood capillaries. Middle ear vasculature, in general, and the tympanic membrane, in particular, offer all the above requirements. By using the tympanic membrane as an anatomic site for the Raman spectroscopy, bioanalyte concentration can be detected and quantified directly from the blood as opposed to being inferred from the interstitial fluid typically used in a non-invasive measurement.

Technology

Molecular spectroscopy has received considerable contemporary attention for diagnosis of diabetes and cancers in various organs, including breast, skin and bladder. The present invention non-invasively detects and quantifies blood analytes, such as glucose from the tympanic membrane. This invention describes a fiber optic probe-based Raman system where the fiber probe is part of a speculum or a wearable device, e.g., headphones. The fiber optic probe can be inserted into the ear of a patient, illuminating the tympanic membrane with one or more wavelengths of light, collecting Raman scattered light by using a detector that is coupled to the fiber optic probe. The spectral data can then be processed for quantification and used to provide periodic measurements of blood analytes. This method would be appropriate as a real-time clinical adjunct for continuous monitoring of glucose and other analytes, e.g., creatinine, urea and bilirubin, in critical care patients and in neonates, where frequent blood withdrawal is particularly problematic.

Advantages

- Non-invasive system for detecting and measuring blood analytes, e.g., glucose
- Bioanalyte concentration is measured from the actual blood as opposed to the interstitial fluid
- Active usage of Raman spectroscopy in clinical and point-of-care setting
Categories For This Invention:

Medical Devices
Diagnostic
Life Sciences
Biotechnology
Health
Clinical Applications
Metabolism, Endocrinology, & Diabetes

Intellectual Property:
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Inventors:
Tulio Valdez
Ramachandra Dasari
Luis Galindo
Rishikesh Pandey
Nicolas Spegazzini

Publications:
Spectroscopic Approach for Dynamic Bioanalyte Tracking with Minimal Concentration Information
Scientific Reports
November 12, 2014

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