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Towards personalized precision medicine: New generation graphene protein microfluidic sensors

Serum glucose, cholesterol, triglyceride and HbA1C monitoring are all valuable tools in the health management of the aging population especially given the increase in diabetes and cardiovascular diseases. Even for glucose monitoring, the challenges in obtaining sufficiently accurate and reliable measurements are so significant. None of them meet the even more stringent requirement of ISO 2012 and FDA. Because inaccurate systems bear the risk of false therapeutic decisions, rising health care costs, there is an urgent compelling need for significantly enhanced BG monitoring systems for PC applications. POC tests for other biomedically important analytes are generally even less accurate. The overall goal of the research in our laboratory and laboratories of our collaborators at Stanford, UC Berkeley, MIT and Rice is to develop new sensor platforms that will provide increased sensitivity and accuracy in point of care situations. Graphene-based platforms decorated by a probe protein enhance the sensitivity of pristine single layer grapheme multi-fold and offers a very accurate determination of critical analytes in the blood and other body fluids including saliva. The proposed system uses advanced graphene, Boron-doped graphene and carbon-nanotube-based sensors to transduce enzymatic binding into electrical signals that can be read and processed by a stand-alone system or even a cell-phone. These new biosensor chips will be housed in a plastic microfluidic system for sample acquisition, preparation and distribution to four separate biosensing chips. This approach will improve accuracy because it reduces operator errors, calibration problems and strip-to-strip variability, while increasing sensor sensitivity/specificity with the option to use redundant sensors for improved statistical confidence.

Biography

Venkatesan Renugopalakrishnan has obtained his PhD in Biophysics from the State University of New York at Buffalo. His graduate studies span both Columbia and State University of New York. He is a Professor at Northeastern University and Boston Children's Hospital, Harvard Medical School where he teaches at the HMS. He is the author of more than 250 papers, Editor of three monographs and is a Member of scientific academies.

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