Graphene based point of care diagnostics and therapeutics

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Graphene is a 2D material with unique electrical and mechanical properties. Graphene devices and sensors promise to be a disruptive technology in next generation electronics and sensors - due to graphene's exceptional electronic properties and aptitude for chemical modification. Novel graphene sensor technology used to develop sensors, based on chemically functionalised graphene microchannels, and their application in lab-on-chip POC (Point-of-Care) diagnostics will be presented. There are several advantages of graphene sensors over alternative sensor platforms such as carbon nanotubes (CNTs) or silicon nanowires (SiNWs). The main benefits of graphene for sensing applications will be highlighted in a comparison with other materials. Important considerations for processing of samples using microfluidics and lab-on-chip technology will be discussed. The latest developments in integration of diagnostics with therapeutics, "theranostics", will be presented – including microneedle sensors. Microneedles (MNs) are tiny microscopic needles, much smaller than conventional hypodermic needles, that can be used to deliver pharmaceutical drugs or vaccines through the skin into the body in a minimally invasive manner. Targeted delivery to the layers just beneath the outer surface of the skin (the stratum corneum) can be used to achieve much more effective drug or vaccine delivery. We are now combining diagnostics with therapeutic MNs. The pros and cons of different MN materials, fabrication techniques and designs will be reviewed. The sharpness of the MN tips is critical to their effective skin penetration. A novel "bevelled tip" MN design is presented which allow sthe MNs to penetrate the skin with lower insertion forces. In addition, hollow MNs have been developed – which can be used to inject significant volumes substances into the skin, compared to coated solid MNs. A review of vaccines, drugs and other entities that can be injected into skin will be presented, along with a discussion of MNs in diagnostic, therapeutic and cosmetic applications.

Speaker Biography

Jacob Mitchell is currently pursuing his PhD in Swansea University, United Kingdom.

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