DeMANS Expert Seminar Series

Monday, 13 October 2025, 11:00 am
Science Lecture Theatre, School of Chemistry, TCD

ORGANIC CONDUCTORS AND BIOMEDICAL DEVICES

Our ability to "listen and talk" to biological systems at the cellular level underpins our ability to fix errant behaviour. Our attempts to treat neuronal dysfunctions, to repair damaged muscle or to promote bone regeneration are all areas that could benefit from improved communications.

Little was I to know that carbon-based electrodes and indeed carbon-based materials would consume me for more than four decades in the quest to overcome this challenge. Inherently conducting polymers, predominantly carbon, remain the most intriguing materials I have encountered. Materials that are capable of interacting with living matter in an unprecedented manner. Capable of inducing development of excitable cells: neurons and muscle cells in a way that conventional metal electrodes could not achieve. Even to the extent that cellular behaviour associated with the effects of schizophrenia could be reduced. Delving into the nanodomain results in the inherent physical properties of conducting polymers being improved and also opens up processing and fabrication options.

With these extraordinary results still not found on med-tech shelves. **Why?**

As time progressed, carbon nanotubes appeared on the scene. Amazing materials with electrical and physical properties second to none. These materials enabled significant advances in biosensing and actuating (artificial muscle) technologies. Innovative approaches to the fabrication of CNT based structures emerged and enabled practical advances in the above fields of application.

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Then graphene came to the party! The use of graphene containing structures captured the imagination of bioengineers fascinated by this most simple of structures: single sheets of carbon. That simplicity belies the complexity in balancing processability with functional properties. Advances have been made: unprecedented levels of communication, enabling us to listen in on neuronal systems hitherto inaccessible through to providing a conduit for electrical stimulation to promote bone regeneration.

In 5 years' time will we be disappointed – we have no real med-tech devices based on graphene? Will we still be asking. **Why?**

Professor Gordon G Wallace

Intelligent Polymer Research Institute, AIIM Facility, Innovation Campus, University of Wollongong, Squires Way, North Wollongong, NSW 2500 Australia

Distinguished Professor Gordon Wallace, an esteemed innovator and educator is a scientist at the forefront of health technologies, where medical devices complement the body's own systems to treat disease and repair injuries.

***DeMANS** is a **Marie Skłodowska-Curie Action** (MSCA) **Research and Innovation Staff Exchange** (RISE) that looks at the design and manufacture of **sustainable materials for additive manufacturing** technologies. DeMANS will explore replacing traditional synthetic plastics with biomaterials in consumer products, simultaneously reducing reliance on fossil fuels and developing new innovations and markets for bio-based products, contributing to the circular economy objectives of the European Green Deal. The DeMANS Expert Seminar Series seeks to present cutting edge research in additive manufacturing, in all its forms.*

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