Melanin considered for bio-friendly electronics

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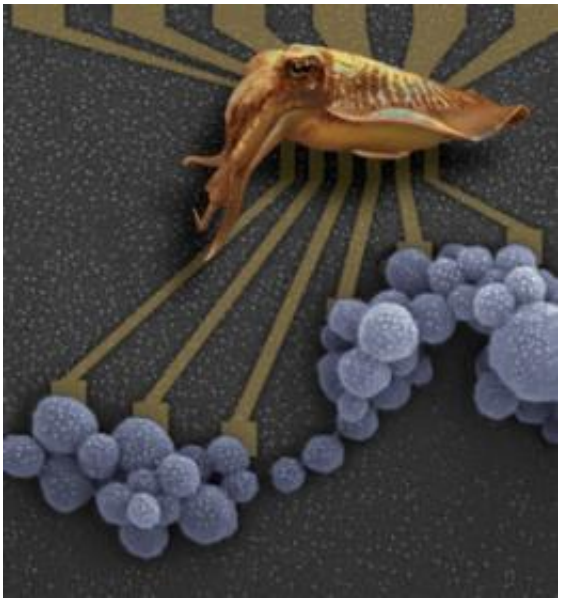

Natural melanins such as squid ink are being considered as new materials for bioelectronics. Credit: Dr Paul Schwenn

(Phys.org) -- Melanin – the pigment that colours skin, eyes and hair – could soon be the face of a new generation of biologically friendly electronic devices used in applications such as medical sensors and tissue stimulation treatments.

Led by Professor Paul Meredith and Associate Professor Ben Powell at The University of Queensland, an international team of scientists has published a study that for the first time gives remarkable insight into the

electrical properties of this pigment and its biologically compatible "bioelectronic" features.

"Semiconductors are arguably the most important modern day high-tech material – they drive all modern electronics," said Professor Meredith.

"The majority of semiconductors are made from inorganic elements or compounds such as silicon or gallium arsenide."

Organic semiconductors, on the other hand, are a relatively new member of the semiconductor family and are composed of molecules containing carbon, hydrogen and other elements.

"There are very few examples of natural organic semiconductors and melanin was thought to be the very first example, demonstrated to be such in the early 70s," said Professor Meredith.

Co-author Associate Professor Powell said that in semiconductors, such as those found in computers and mobile phones, electrons carry the electrical current. However, in biological systems, such as brains and muscles, ions carry the current.

"We've now found that in melanin, both electrons and ions play important roles," he said.

The study – published recently in *Proceedings of the National Academy of Sciences* – points to a new way of interfacing conventional electronics to biological systems using a combination of ion-and-electron conducting biomaterials such as melanin.

"Melanin is able to 'talk' to both electronic and ionic control circuitry and hence can provide that connection role," said Professor Meredith about the study's finding, the culmination of ten years of research and

experiments.

“There are very few materials that meet these compatible bioelectronic requirements, and an insight into melanin's important biological functions and properties has been really crucial in this study.”

In recent years, the electronics industry has been driven to develop materials and components that are cheaper and more environmentally friendly.

“There is a realisation that in many such applications, we should move on from the relatively more expensive inorganic semiconductors. We need cheaper, safer electronic materials with greener credentials,” said Professor Meredith.

“Organic conductors and semiconductors are widely viewed has having enormous potential in this regard, and in the area of medical sensors and devices, biocompatibility will be a key requirement.”

The team is currently working on creating ion-based electrical devices using melanin, with a view to ultimately connect them to actual biological systems.

“A critical area that one could foresee for bioelectronics is stimulating or repairing signal-carrying pathways in tissues such as muscle or brain,” said Professor Meredith.

Other researchers in the study are Professor Ian Gentle, Professor Graeme Hanson, Dr Bernie Mostert (currently at Lancaster University and central figure in the research) -- all from The University of Queensland, as well as researchers from the United Kingdom and Poland.

More information: The paper, Role of semiconductivity and ion transport in the electrical conduction of melanin, by Mostert et al., can be viewed online here.

Provided by University of Queensland