Connect the Quantum Dots

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A new study, published today in the current issue of the Proceedings of the National Academy of Sciences has significant implications for the design of disease markers and the development of chemoreceptors used in human biomedical research. The groundbreaking study, entitled, "A Mechanism to Signal Receptor-Substrate Interactions with Luminescent Quantum Dots", demonstrates that quantum dots can one day replace conventional organic dyes in biomedical applications.

By using the unique photophysical properties of quantum dots, researchers Drs. Francisco Raymo, Ibrahim Yildiz, and Massimilliano Tomasulo were able to identify operating principles to probe molecular recognition events with luminescence measurements. These findings demonstrate that mechanisms based on photoinduced electron transfer can be exploited to transduce a recognition event into a significant change in the luminescence of a quantum dot. This research proves this important fundamental principle and lay the necessary groundwork for researchers to further improve its sensitivity, stability and reproducibility for biomedical applications.

"Our method has a long-term impact on biomedical diagnostic applications which currently rely on the fluorescence of organic dyes," says Francisco Raymo, Ph.D., associate professor of chemistry in the University of Miami's College of Arts and Sciences. "For example, our strategy can be designed to signal specific disease markers in biological samples thus replacing conventional organic dyes in a diversity of imaging and sensing applications."

Fluorescence microscopy and spectroscopy have become invaluable analytical tools in biomedical research but rely on the fluorescence of organic dyes which have limited luminescent properties. Quantum dots have superior photophysical properties and will presumably replace conventional organic dyes in biomedical applications. These findings will stimulate the use of quantum dots in the biomedical research and development of disease markers and chemosensors.

"On its own this research paper is very significant and ahead of its time in the field of nanotechnology," says Alexey Titov, Licensing Manager for the University of Miami's Office of Technology Transfer. "However, it also has commercial applications which are a truly outstanding and rare combination."

Two patent applications have been filed by University of Miami Office of Technology Transfer on behalf of Dr. Raymo and colleagues for these inventions and the university is in the process of finding an industrial partner capable of commercializing these inventions.

Quantum dots, one of the smallest nanoscience research tools, range from 2 to 10 nanometers in diameter; nearly 3 million quantum dots would be needed to fit within the width of a thumb. By virtue of their distinct colors, quantum dots have quickly found their way into homes in many electronic lasers including the new PlayStation 3 and high-definition DVD players. Nanotechnology, the understanding and control of matter at dimensions of roughly 1 to 100 nanometers, is valuable research since matter at the nanoscale has unique properties that enable novel applications. Medical researchers work at the nano-scales can develop new drug delivery methods, therapeutics and pharmaceuticals.

Source: University of Miami Rosenstiel School of Marine & Atmospheric Science