Fluorescing Nanoparticles, Called CU Dots, Could Further Microbiological Research

Sometimes innovation really is accompanied by a sudden flash of light, as experienced by Ulrich B. Wiesner, Materials Science and Engineering, and Hooisweng Ow, one of Wiesner's Ph.D. students. They created a new, nanoscale fluorescent bead. The novel fluorescent beads, referred to as CU Dot fluorescent nanoparticles or CU Dots, for short, are comparable to the much-hyped quantum dots in brightness and size, but lack their toxicity. Therefore, CU Dots can easily be used in the life sciences, for example, to track the motion of proteins on cell surfaces or to visualize biological entities (bioimaging) as in the labs of Barbara A. Baird, Chemistry and Chemical Biology; Nanobiotechnology Center.

CU Dots consist of a core of fluorescent dyes encapsulated in a shell of silica (glass). The fluorescent dyes emit light when excited by an external light source. CU Dots have been fabricated in various "flavors," each flavor emitting light at a different frequency—thus far, in the UV-visible spectrum from 350 nm to 800 nm. Because the silica shell acts to insulate the dyes from the effect of solvents or other chemicals, such as oxygen, in their immediate environment, the dyes embedded in the CU Dot nanoparticles do not lose brightness over time as fast as they do when floating freely in solution.

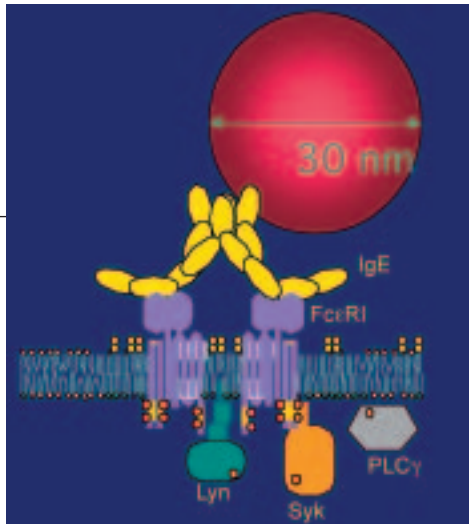
CU Dot fluorescent nanoparticles are created using a synthesis technique known as the sol-gel process. Sol-gel chemistry allows researchers to synthesize silica-based materials under benign conditions, such as at room temperature and without the use of harmful chemicals.

Many applications exist for CU Dot fluorescent nanoparticles. Foremost among them is the use of CU Dots for bioimaging and biosensing, for example, as fluorescent markers in biological systems. CU Dots are so bright that it is possible to see the light emitted by a single particle through a microscope. Watt W. Webb, Applied and Engineering Physics, and others in his lab, are exploring the use of CU Dots in multiphoton microscopy, while Antje Baeumner, Biological and Environmental Engineering, is experimenting with CU Dots as part of a chemical detection system.

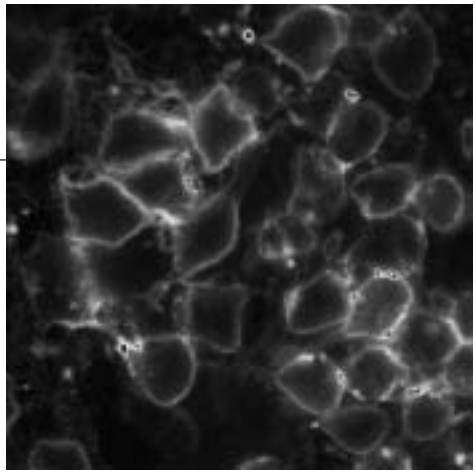
Other potential applications include the use of CU Dots as drug delivery vehicles, in display technologies, and as additives for plastics, inks, and paints to give them long-lasting fluorescence. The Cornell Research Foundation is currently exploring several avenues for commercializing this promising new technology. This includes talks with venture capitalists who are interested in creating a company around CU Dots and hybrid silica technologies based on the sol-gel process.

Scott S. Macfarlane
Senior Licensing Associate, Physical Sciences

CU Dots "Flavors"



CU Dots as fluorescent tag for protein



Imaged mast cells using CU Dots.

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Charles Harrington/CU

Ulrich Wiesner, Materials Science and Engineering, and Ph.D. student Hooisweng Ow (not pictured) created a new nanoscale fluorescent bead.

CU Dots are so bright that it is possible to see the light emitted by a single particle through a microscope.

Robert Barker/CU

Watt Webb, Applied and Engineering Physics, is exploring the use of CU Dots in multiphoton microscopy.

Nicola Kountoupes/CU

Antje Baeumner, Biological and Environmental Engineering, is experimenting with CU Dots as part of a chemical detection system.

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