Intricate algae produce low-cost biosensors

1 September 2014, by Rachel Robertson

(Phys.org) —Oregon State University researchers are combining diatoms, a type of single-celled photosynthetic algae, with nanoparticles to create a sensor capable of detecting miniscule amounts of protein or other biomarkers.

This is a new and innovative approach to optical biosensors, which are important in health care for such applications as detecting levels of blood glucose or the presence of antibodies. They are also used for chemical detection in environmental protection.

Existing biosensors often require high-cost fabrication using artificial photonic crystals to make a precisely structured device. But diatoms appear to have just the right kind of intricate structure to integrate with gold or silver nanoparticles and produce a low-cost optical biosensor.

"I've been working on this kind of sensor for a long time, and using diatoms instead of fabricating photonic crystals makes life much easier," said Alan Wang, an assistant professor of electrical engineering in the OSU College of Engineering. "And from a commercial point of view it's much lower cost, about 50 cents compared to $50."

Jeremy Campbell, a graduate student in chemical engineering working with OSU professor Greg Rorrer, brought the diatom to Wang's attention. This launched a collaboration sponsored by the Oregon Nanoscience and Microtechnologies Institute and Marine Polymer Technologies.

Although diatoms are being studied by other groups for applications such as batteries, no one else is researching their use for optical biosensors. Producing a low-cost sensor is important for a consumable product that is thrown away after one use.

Research has shown that using diatoms boosts the performance of the nanoparticles by increasing the absolute value of the signal by 10 times, and the sensitivity by 100 times. The current sensitivity of the OSU biosensor is 1 picogram per milliliter, which is much better than optical sensors used in clinics for detecting glucose, proteins and DNA, which have a sensitivity of 1 nanogram per milliliter.

"Combining naturally created structures with chemically synthesized nanoparticles has the potential to revolutionize the fabrication of photonic devices," Wang said.

Provided by Oregon State University