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FAST BREAKING PAPERS - 2009

December 2009

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Kimberly Hamad-Schifferli talks with *ScienceWatch.com* and answers a few questions about this month's Fast Breaking Paper in the field of Chemistry.

Article Title: Selective Release of Multiple DNA Oligonucleotides from Gold Nanorods

Authors: Wijaya, A;Schaffer, SB;Pallares, IG;**Hamad-Schifferli, K**

Journal: ACS NANO, Volume: 3, Issue: 1, Page: 80-86, Year: JAN 2009

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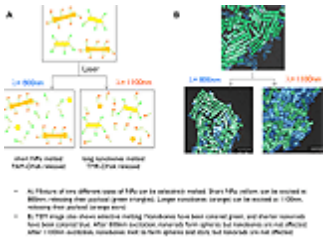
SW: Why do you think your paper is highly cited? Does it describe a new discovery, methodology, or synthesis of knowledge?

One of the most exciting prospects of nanotechnology is that nanoparticles can act as a handle by which one can control nanoscale processes, particularly biological ones. Due to their size, nanoparticles can reach places where such processes are typically inaccessible to external manipulation, such as inside individual cells.

The allure of externally controllable "nanoantennas" and "nanobots" is that they can control the inner workings of biological machines by releasing molecules or signals that can dictate biomolecular and cellular behavior. In addition, nanoparticles can carry a large payload and be decorated with molecules that can target them to specific types of cells.

Due to their physical properties, they can also be simultaneously tracked and imaged. Consequently, nanotechnology has held great promise for enhancing existing biological systems as well as engineering new capabilities in biology.

This paper was the first to use gold nanorods for multichannel control of a biological process. We used lasers to selectively heat different nanorods to release two different species independently. This technique we developed has unique advantages for improving combination therapy, the use of drug cocktails/mixtures, which is used to treat many complex diseases. The paper describes a new methodology.



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Would you summarize the significance of your paper in

layman's terms?

Complex diseases such as HIV and cancer require a mixture of drugs, or a so-called "drug cocktail," to treat them. For the best efficacy of the drug, each of the drugs in the mixture must be released at specific times and in specific amounts. Our technique using gold nanorods is a way to control the release of more than one drug precisely, to release the right amount of each drug at specific times.

How did you become involved in this research, and were there any problems along the way?

We have always been interested in using nanoparticles for biological applications, and this was one of the ways that nanotechnology can be exploited for biology. The biggest challenge was overcoming surface problems of the nanorods, since, due to their small size, they are dominated by their surfaces. If the surfaces of the nanorods are not "clean," they tend to clump in biological solutions, preventing any sort of handling. We had to come up with a new way to clean up their surface chemistry first before attempting to do this research.

Where do you see your research leading in the future?

This paper was simply a proof-of-principle experiment, to show that selective release could be done. We are now using this technique for things such as cancer therapy and medical applications, in addition to using it as a tool for studying biological behavior on the molecular and cellular level.

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KEYWORDS: DRUG-DELIVERY; MAGNETIC NANOPARTICLES; SURFACES; GROWTH; FUNCTIONALIZATION; DISSOCIATION; THERAPY; SYSTEM; SHAPE.

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