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May 31, 2005

Nanorods Deliver Vaccines, Trigger Strong Immune Response

Gene-based vaccines, which use DNA to induce immune system cells to mount a targeted immune response, hold promise for treating and preventing cancer, but delivering DNA to the proper cells has proven difficult. Now, a multi-institutional team of collaborators has shown that DNA-bearing nanorods delivered to immune cells through the skin will trigger a strong antibody response. Nanorods may prove to be particularly useful in vaccination applications because they can be modified to carry multiple antigens as well as chemicals that stimulate the immune system to respond to antigens.

In a paper published in the journal *Nanotechnology*, investigators led by Kam Leung, Ph.D., of Johns Hopkins School of Medicine, describe *in vivo* studies designed to test the hypothesis that gold/nickel nanorods decorated with antigen, which the researchers had made previously, will induce an antigen-specific immune response. Nanorods comprising two equal segments of nickel and gold, each 800 nanometers long and 170 nanometers in diameter, were decorated with DNA and the protein antigen ovalbumin. DNA was attached to the nickel segment, while ovalbumin was attached to the gold segment.

Mice were then immunized with the resulting nanorods using a gene gun, which forces the particles through the outer layers of the skin to a layer that is rich with antigen-processing cells. The mice received a booster injection two weeks after the initial immunization. For comparison, the researchers also immunized groups of mice with ovalbumin-nanorod constructs, ovalbumin and DNA on gold nanoparticles, and DNA-nanorod constructs. Serum samples taken 21 days after the booster immunization showed that the strongest immune response, measured by the production of antibodies to ovalbumin, resulted from nanorod construct containing both ovalbumin and DNA.

This work is detailed in a paper titled, "Multicomponent nanorods for vaccination applications." Researchers from the University of Iowa also participated in this study. An abstract is available through the journal's website.

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The initial work from Dr. Leong's group on using multifunctional nanorods for DNA delivery was detailed in a paper titled, "Multifunctional nanorods for gene delivery." That paper appeared in the journal *Nature Materials*. An abstract is available through PubMed.

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