NEWS RELEASE

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Nanomaterials: How Much is Too Much? It's No Small Question

FOR IMMEDIATE RELEASE

Good things may come in small packages, but what are the effects of those small packages on humans and the environment? New research on nanomaterials – materials billionths of a meter in size – at North Carolina State University's College of Veterinary Medicine may help answer some of those questions.

The prefix nano- comes from the Greek word for dwarf. And nanoparticles are very small indeed. Any particle between 1 and 100 nanometers is considered to be a nanoparticle. Nanomaterials have many uses: They can make items stronger or lighter, and even heat- or stain-resistant. They are used in tennis rackets, cosmetics, electronics and drug delivery.

Dr. Nancy Monteiro-Riviere, professor of investigative dermatology and toxicology at NC State's Center for Chemical Toxicology Research and Pharmacokinetics, is studying how nanomaterials interact with the skin, specifically absorption and toxicity. Her research is funded through a three-year, $340,000 Environmental Protection Agency (EPA) Science to Achieve Results (STAR) grant.

In the study, Monteiro-Riviere will investigate several classes of nanomaterials, including fullerenes, quantum dots, single-wall and multi-wall nanotubes and nanofibers, as well as bucky balls – a spherical grouping of carbon chains. "Many of these nanomaterials come in a variety of sizes, shapes and compositions, so you can't just look at one. I'm trying to evaluate the effects of engineered nanomaterials on cells," she said.

"They can be exceptionally strong and so miniaturized, such as in semiconductors and microchips. The concern is that people are manufacturing these things but they aren't evaluating what's going to happen when occupational exposure occurs or these nanomaterials accumulate in the environment."

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Early studies of multi-wall carbon structures have shown they can cause irritation and incorporate themselves into the keratinocytes (skin cells). Monteiro-Riviere wants to find out if nanomaterials will penetrate through all the layers of the skin. If nanomaterials penetrate into the dermis, where the capillaries are, they can get picked up and transported through the bloodstream, and may localize in other target organs.

"People are handling these materials on a daily basis, but there is limited research or literature out there on the materials' toxicity," she said. "Nanomaterials can be very versatile. You can make them water soluble or lipid soluble, you can manipulate them for your own good, use them for drug delivery, but how are you going to dispose of them? How are they being released into the atmosphere?"

According to Monteiro-Riviere, many nanoparticles are made of carbon, which means they aren't really going to degrade. "How long are they going to exist in our environment? Some early research has shown these particles can find their way into the smallest part of the lung and may cause problems. And their small size makes them difficult to detect. However, we really do not know their impact on human health. It is just too early to speculate."

Monteiro-Riviere's research has been featured recently in a number of scientific publications, including selection as an editor's choice in the journal *Science.* "I'm getting many calls and e-mails from reporters looking for more information about this research; my work is even featured in an exhibit at the London Science Museum," she said.

"It's a new and exciting field but when we develop all these unique nanomaterials, we need to know what the effects are on the body and the environment. We have to be very careful. Hopefully we can use the research results to help other agencies develop guidelines for exposure to nanomaterials," Monteiro-Riviere said.

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