# Study points way to communicating nanotech

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If you could paint a gallon of paint one nanometer thick, how much area could you cover? The surprising answer-about 930 acres, or slightly larger than New York's Central Park-certainly makes fun trivia fodder.

More importantly, however, it points nanotechnology researchers to strategies that help them more effectively communicate the scale, scope and "wow" of their work to non-technical audiences.

With consumer applications in everything from clothing, personal-care products and sporting goods to air purification systems, computers and home appliances, nanotechnology rapidly is becoming an integral part of everyday life. Yet survey results show that public audiences largely lack awareness and understanding of nanotechnology concepts, says Olivia Castellini, a former postdoctoral researcher with the University of Wisconsin-Madison Materials Research Science and Engineering Center (MRSEC) Interdisciplinary Education Group.

"In the very near future, the public will be asked to make a variety of decisions about nanotechnology, including whether or not to purchase nanotechnology products, how nanotechnology should be regulated-if at all-and whether public funding should be used to support nanotechnology research," she says. "The more knowledge and awareness the public has about nanotechnology, the better prepared they will be to make these kinds of decisions."

Now an exhibit developer in the Chicago Museum of Science and Industry Department of Science and Technology, Castellini led a study in

which she and three undergraduate interns surveyed 495 people ages 7 to 91 to test their knowledge of atoms, nanotechnology and size scale, and to assess their attitudes toward nanotechnology.

The group published its results, also available online, in Vol. 992 of the *Journal of Nanoparticle Research*.

"Our most significant finding is that public knowledge of fundamental science concepts related to nanotechnology varies a great deal based on age and educational experience," says Castellini.

Many survey respondents who had heard about nanotechnology said they learn about it from mass media like television, newspapers, movies or the Internet, yet less than 20 percent of all respondents could correctly define it as science and technology on a tiny scale (there are about 25 million nanometers in an inch).

In addition, survey responses relating to the size scale of such microscopic objects as an atom, cell, bacterium and water molecule showed that people find it difficult to grasp concepts they cannot visualize.

"The ideas that atoms are the building blocks of matter and a conceptual understanding of the tiny size of the nanoscale are central to understanding nanotechnology concepts," says Castellini. "Our study found that the majority of people educated at the middle-school level or higher could recall facts about atoms-but that fact-based knowledge did not necessarily guarantee their conceptual understanding of them."

The survey originated in fall 2004 when she and the students began developing museum exhibit prototypes about nanotechnology. At the time, they found very little published information about public knowledge of nanotechnology, says Wendy Crone, a UW-Madison

associate professor of engineering physics. "The study was really crucial for our appreciation for what the public knows about nanotechnology and for our appreciation of the difficulties we would face in developing exhibits that involve a size scale that's smaller than you can see," says Crone, who directs the MRSEC Interdisciplinary Education Group.

Communication strategies that emerged from the study also enabled group members to deliver more meaningful nanotechnology information in face-to-face interactions with audiences like schoolchildren, K-12 teachers and the public, says Crone. "We learned some things that we had been doing wrong and adjusted how we were presenting information based on the research findings," she says.

Researchers commonly communicate nanotechnology concepts to general audiences via formal and informal public lectures, outreach events, and demonstrations. "One of the mistakes that's very common for researchers to make is to assume that, if I just blurt out everything I know, that people will get something from it," says Crone. "That one-way distribution of information isn't very effective."

Rather, says Castellini, researchers first should assess how much their audiences know about basic nanotechnology concepts such as atoms and size scale, and conduct a review, if necessary. "Highly visual presentations are particularly effective for this purpose," she says. "Additionally, we recommend limiting the number of nanotechnology concepts to two or three to prevent the audience from feeling overwhelmed with too much information."

As a result of the study, Crone has made her frequent nanotechnology talks more interactive and now includes nano "fun facts" and real-life examples and analogies that pique audience curiosity and encourage dialogue. One particularly successful example is the statement, "In the time it takes you to read this sentence, your fingernails will have grown

one nanometer."

In the case of nanotechnology, the researchers learned that public audiences have a fairly neutral opinion of nanotechnology. "This is actually good news," says Castellini. "As public awareness and knowledge of nanotechnology grows, researchers may be able to avoid overcoming negative opinions or preconceived notions about the technology," she says.

In addition to Castellini and Crone, other paper authors include Gina K. Walejko, Carie E. Holladay, Terra J. Theim and Greta M. Zenner.

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