Scientists to Test Toxicity of Nanomaterials

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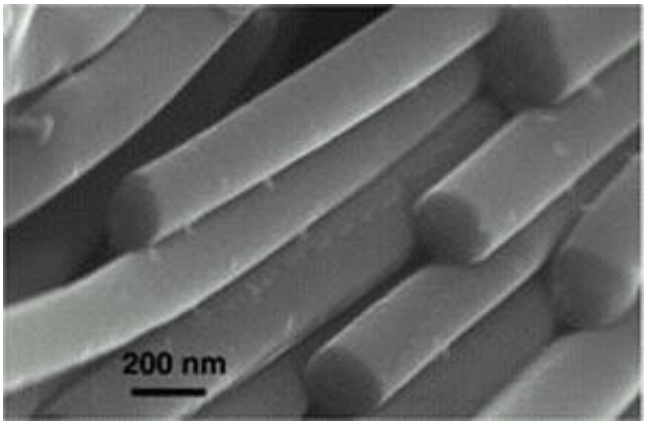

Materials science is getting small – on the order of the atomic scale. Fibers, spheres, crystals and films 1,000 times thinner than human hair hold the promise of producing faster cars and planes, more powerful computers and satellites, better microchips and batteries. Inventors even plan to use nanomaterials to make artificial muscle, military armor and medicines. Nanomaterials can already be found in sunscreens, concrete, tennis rackets, car bumpers and wrinkle-resistant clothes. But are they safe?

Through a new four-year, $1.8-million National Science Foundation grant, Brown University scientists are testing a variety of nanomaterials to see how they interact with human and animal cells. The aim: Find out which sizes, shapes, compounds and coatings damage or kill cells. That

information can be used to manufacture non-toxic types.

“The question isn’t whether nanomaterials are good or bad,” said Robert Hurt, a Brown professor of engineering and the lead investigator on the project. “The question is which are toxic? Under what conditions? And can we make and purify them in different ways to avoid toxicity – to make ‘green’ nanomaterials?”

The grant supports important early work at Brown in an emerging field of environmental health.

According to the Institute of Medicine, the federal government last year invested nearly $1 billion in nanotechnology, yet little is known about how engineered nanoparticles affect human health. To fill the knowledge gap, the National Science Foundation and other government agencies are spending a total of $38.4 million this fiscal year in research on the environmental, health and safety aspects of nanomaterials. A journal, *Nanotoxicology*, was launched this year along with the first database of research on the biological and environmental impacts of nanoparticles.

Hurt said nanoparticles have captured the imaginations of materials scientists and chemists because they have desirable properties such as extreme strength or outstanding electrical or thermal conductivity. However, a small number of animal studies show that some nanomaterials can damage brain or lung tissue or block blood flow.

To better understand which materials are toxic and which are safe, the Brown project takes a multidisciplinary approach.

In the Division of Engineering, Hurt and colleague Gregory Crawford are creating carbon nanotubes, fibers and spheres – all popular in electronics – by the billions. Crawford is arranging the materials on glass slides based on size, shape and chemical composition, a novel “chip”

platform that will allow for precise, systematic testing.

The chips will then head to Jeffrey Morgan and Agnes Kane at Brown Medical School.

Morgan, a biologist and tissue engineer, will test the materials' affect on lab-grown human skin cells. Kane, a pathologist, will test the materials on macrophages, cells that defend against foreign invaders, culled from mice. Both will check to see if cells die, incur DNA damage or trigger exaggerated immune defenses.

Phil Brown, professor of sociology and environmental studies, will explore the social and ethical implications of nanotechnology and how to communicate health exposure risks to the public, including faculty and students who work with nanomaterials in campus labs.

Source: Brown University

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