

Repetitive motion speeds nanoparticle uptake

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Newly published research by Rice University chemists and North Carolina State University toxicologists finds that repetitive movement can speed the uptake of nanoparticles through the skin.

The research is based on in vitro experiments involving animal skin that was exposed to buckyball-containing amino acids. It appears in the Jan. 10 issue of the American Chemical Society's journal *Nano Letters*.

"Our results confirm that repetitive motion can speed the passage of nanoparticles through the skin," said Nancy Monteiro-Riviere, professor of investigative dermatology and toxicology at NC State. "As more nanoparticles find their way into the workplace and consumer goods, and as scientists look for innovative ways to use nanoparticles to delivery drugs into the body, it is critical that the nanoscience community identify these types of external exposure factors."

In the study, a solution of buckyball-containing amino acids were placed on small sections of pig skin. In some experiments, the skin was held still, and in others it was flexed for either an hour or an hour and a half. Measurements were taken eight hours after exposure and 24 hours after exposure.

The team found that the more the skin was flexed, the more buckyballs it took up and the deeper they penetrated. Penetration was also found to be deeper after 24 hours than after just eight.

Buckyballs, are spherical, soccer-ball-shaped molecules containing 60



carbon atoms. The buckyballs used in the study were part of an innovative molecule called Bucky amino acid, or Baa, that was created in the lab of Rice chemist Andrew Barron. Baa is a marriage of buckyballs and phenylalanine, one of the 20 essential amino acids that are the building blocks of all proteins.

"The findings were a bit surprising because the Bucky amino acids tend to form spherical clusters that are up to 12 times larger in diameter than the known width of intercellular gaps in the skin," said Barron, the Charles W. Duncan Jr.-Welch Professor of Chemistry, professor of materials science and associate dean for industry interactions and technology transfer. "It's not clear why flexing increases the uptake of fullerene peptides, but it will be important to further investigate these mechanisms as we study the medical potential of Bucky amino acids."

Source: Rice University

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