Nanoparticle research and the future of medicine

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(Phys.org)—A review paper by UCD researchers describing how nanoparticles can gather a cloak of molecules onto themselves in the human body is featured on the front cover of *Nature Nanotechnology*.

The concept stands to have profound implications for nanomedicine, which includes improved drug delivery and the ability to diagnose disease earlier, and the safe regulation of nanotechnology.

Nanoparticles have dimensions of less than 100 nanometres. They are of scientific interest because at this scale materials engage with cells and organisms in a completely new way, explains the paper's lead author Professor Kenneth Dawson, Director of the Centre for NanoBioInteractions at University College Dublin.

"That can be good - you can do all sorts of new things with nanoparticles. You can cross biological barriers that you couldn't normally cross, and deliver nanoparticles into organs you couldn't usually access," he says.

"But for that very same reason we also address the safety question, because particles can accumulate in high concentrations in tissues where they wouldn't normally go."
This understanding will support the safe implementation of nanotechnology, as well as its effective application in drug delivery and therapeutics, he adds.

Professor Dawson and colleagues at University College Dublin have made important insights into what happens when a 'bare' nanoparticle gets into a new environment, whether it's a living organism or a milieu such as a river. They have shown that nanoparticles draw down or adsorb molecules onto their surfaces to form a cloak known as a corona, and it's this corona of proteins and fats that ultimately interacts with the body rather than the nanoparticle material itself.

"Nanoparticles cloak themselves in quite different ways than previous larger particles or drug molecules, meaning they can acquire almost the full range of biological activities that proteins can," says Professor Dawson. "[And] whatever is adsorbed onto the nanoparticle becomes its address label, and that influences how the nanoparticle will function in the body."

There's also some evidence that as a nanoparticle moves through various parts of the body it could retain a 'corona memory' of where it has been, and that could affect how nanoparticles distribute in different organs.

Professor Dawson and his team at UCD have been developing tools to analyse the patchwork of molecules that make up the corona under different experimental circumstances.
"A lot of brilliant young colleagues have been involved in helping build this story, and it is a pleasure to see them also achieve recognition," he says.

"We have come a long way from the early days when these ideas seemed unfamiliar to most scientists in nanotechnology. The concept has now come of age: it is now the broadly accepted paradigm in the research community. Now we know where we are going. It is time to see if we can overcome some of the barriers to making practical advances."

Provided by University College Dublin