New discovery reveals fate of nanoparticles in human cells

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Scientists funded by the Biotechnology and Biological Sciences Research Council (BBSRC) have uncovered what happens to biomimetic nanoparticles when they enter human cells. They found that the important proteins that make up the outer layer of these nanoparticles are degraded by an enzyme called cathepsin L. Scientists now have to take this phenomenon into account and overcome this process to ensure the exciting field of nanomedicine can progress. The research is published today in *ACS Nano*.

Dr Raphaël Lévy, a BBSRC David Phillips Fellow at the University of Liverpool and lead researcher on the project said: "We've known for some time that nanoparticles are taken into cells and there have been experiments done to establish their final destinations, but we didn't know until now what state they are in by the time they get there."

In most biological applications, nanoparticles are coated with a layer of molecules, often proteins, which determine the use of nanoparticles when they enter cells. The researchers have confirmed, in a wide range of cells, that nanoparticles are taken into a region called the endosome, where this essential coating is degraded by cathepsin L.

Dr Violaine Sée, also a BBSRC David Phillips Fellow at the University of Liverpool, and joint corresponding author, added: "One of the promising applications of nanoparticles in medicine is to use them as a method to deliver therapeutic protein molecules inside cells. For these biological therapies to be effective the proteins have to be maintained

with high integrity and unfortunately we have seen this compromised by the degrading action of cathepsin L."

The design of any intracellular nanodevice must now take into account the possibility of cathepsin L degradation and either bypass the endosome area all together or have some built-in inhibition of the enzyme.

Dr Lévy continued: "The methods we have developed will help with this as we can now measure the location and the state of the nanoparticle quickly and quantitatively."

Professor Douglas Kell, BBSRC Chief Executive said: "Nanotechnology is an interesting area that has the potential to push all sorts of technological boundaries. There is promise of some useful applications in biology and we've already seen some excellent results with the development of nanomagnetic technology to guide therapeutic proteins and DNA to specific sites to treat tumours, for example. Fundamental bioscience research such as this, helps drive forward nanomedicine to ensure it has a real impact on health and wellbeing in the future."

Source: Biotechnology and Biological Sciences Research Council (news : web)