Research provides new findings on drug delivery with nanoparticles

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Researchers have over time been able to show that medicine designed at nanoscale offers unprecedented opportunities for targeted treatment of serious diseases such as cancer. However, now research also shows that the body's immune system plays a significant part in the drug delivery process.

"Researchers today are able encapsulate medicine in nanoparticles the size of viruses. The nanoparticles are effective for drug delivery – the delivery of the medicine to the body – because they can very precisely find diseased cells and carry the medicine to them. This means that you can suffice with less dosage and thereby fewer side effects," explains Professor Moein Moghimi from the Faculty of Pharmaceutical Sciences at the University of Copenhagen.

Professor Moghimi has along with colleagues at the University of Brighton and the Technical University of Denmark recently published a landmark paper in *ACS Nano* regarding the immune system's attack on nanoparticles.

The new research has shown that the coating of the nanoparticle surface has great influence on the activation of the immune system – the particle's polymer coating can be designed in various ways, and the form can drastically change the body's immune response.

"Drug delivery with nanoparticles camouflaged as water soluble polymers has proven very effective. One way of delivering drugs safely

to diseased sites in the body is to encapsulate them in small polymeric particles in similar size to viruses. However, when injected into the blood these particles are intercepted by the body's defence system. This can be overcome by camouflaging the surface of these nanocarriers with water soluble polymers. This makes the surface 'water-like' and less visible to the immune system," says Professor Moghimi.

Professor Moghimi works at the Department of Pharmaceutics and Analytical Chemistry where he heads the Centre for Pharmaceutical Nanotechnology and Nanotoxicology, which is supported by the Danish Agency for Science, Technology and Innovation. This work was done as part of ongoing research at the Centre.

Professor Moghimi's main focus is nanotoxicology – and the possible consequences of drug delivery with nanoparticles.

"Our newest research indicates that we should be very cautious when designing the surface of the nanoparticles. Remarkably, changing the conformation of the coating polymers on nanoparticle surface from a 'mushroom-type' to a 'brush-type' appearance can switch complement activation from one pathway to another," explains Professor Moghimi.

The research demonstrates difficulty in design and surface engineering of polymeric nanoparticles such that it is hydrophilic enough to be compatible with biological fluids and yet prevent complement activation.

This is also very important from clinical perspectives since complement activation may induce adverse reactions in some patients.

The importance of this work was also highlighted in an all exclusive "News and Views" by the prestigious *Nature Nanotechnology*.

Provided by University of Copenhagen