Soft core, hard shell – the latest in nanotechnology

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Nanoparticles are the smallest particles capable of reaching virtually all parts of the body. Researchers use various approaches to test ways in which nanoparticles could be used in medicine – for instance, to deliver substances to a specific site in the body such as a tumor. For this purpose, nanoparticles are generally coated with organic materials because their surface quality plays a key role in determining further targets in the body. If they have a water-repellent shell, nanoparticles are quickly identified by the body's immune system and eliminated.

How gold particles wander through the body

The team of scientists headed by Dr. Wolfgang Kreyling, who is now an external scientific advisor at the Institute of Epidemiology II within the Helmholtz Zentrum München, and Prof. Wolfgang Parak from the University of Marburg, succeeded for the first time in tracking the chronological sequence of such particles in an animal model. To this end, they generated tiny 5 nm gold nanoparticles radioactively labeled with a gold isotope. These were also covered with a polymer shell and tagged with a different radioactive isotope. According to the researchers, this was, technically speaking, a very demanding nanotechnological step.

After the subsequent intravenous injection of the particles, however, the team observed how the specially applied polymer shell disintegrated. "Surprisingly, the particulate gold accumulated mainly in the liver," Dr. Kreyling recalls. "In contrast, the shell molecules reacted in a

significantly different manner, distributing themselves throughout the body." Further analyses conducted by the scientists explained the reason for this: so-called proteolytic enzymes in certain liver cells appear to separate the particles from their shell. According to the researchers, this effect was hitherto unknown in vivo, since up to now the particle-conjugate had only been tested in cell cultures, where this effect had not been examined sufficiently thoroughly.

"Our results show that even nanoparticle-conjugates that appear highly stable can change their properties when deployed in the human body," Dr. Kreyling notes, evaluating the results. "The study will thus have an influence on future medical applications as well as on the risk evaluation of nanoparticles in consumer products and in science and technology."

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