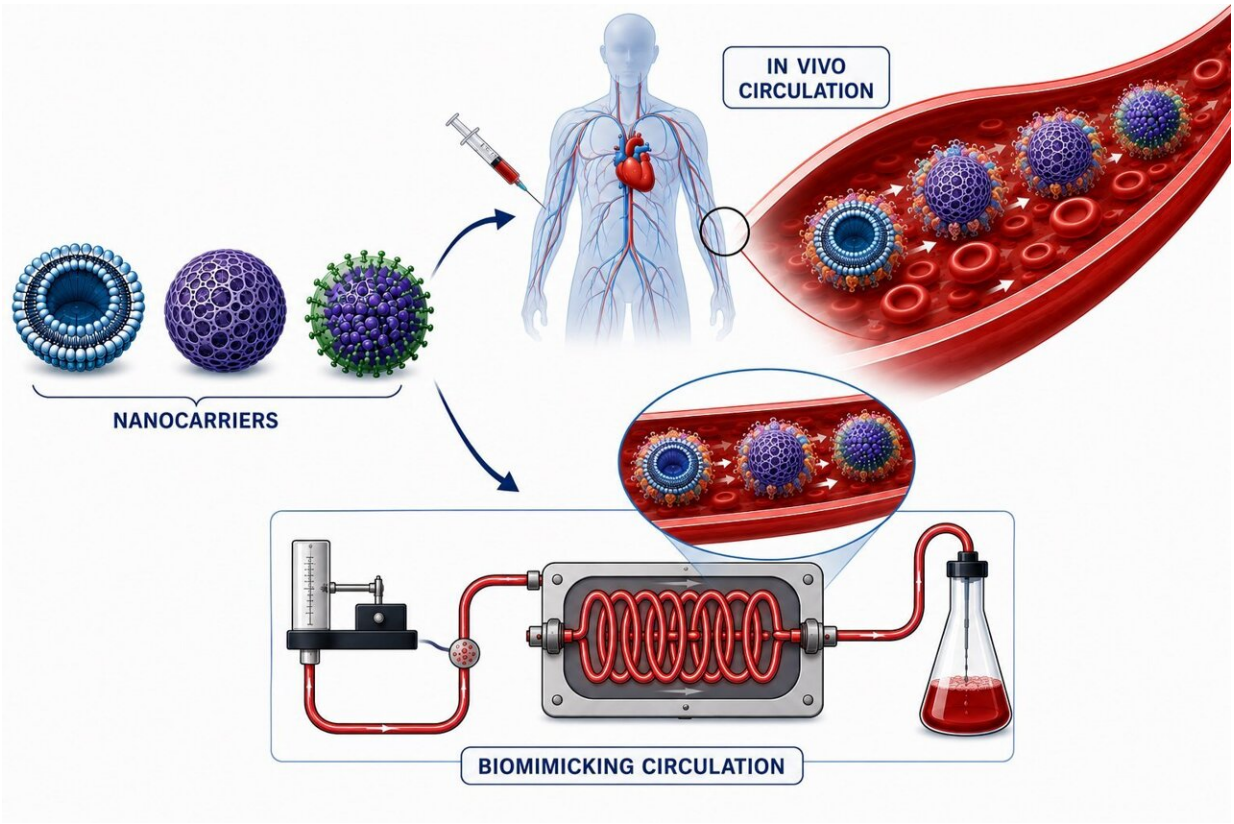
What happens to nanoparticles when they enter the bloodstream?

August 12 2026



To study how nanoparticles behave in the bloodstream, researchers have developed a dynamic artificial circulatory system that mimics natural blood flow and protein conditions in the human body. Credit: O. Tagit (FHNW), created with ChatGPT

The use of nanoparticles in drug delivery offers key advantages: they can

enable targeted drug delivery, protect active ingredients from premature degradation, extend their duration of action in the body and reduce side effects. However, as soon as nanoparticles come into contact with blood, proteins from the blood adsorb onto their surface—forming a so-called protein corona. This corona influences whether the particles are taken up by cells, how they distribute in the body or whether the immune system recognizes and attacks them.

To date, research has primarily focused on the protein coronas of hard nanoparticles, such as gold. Yet many nanoparticles relevant for clinical drug delivery—like liposomes and polymer nanoparticles—are soft and flexible. Their protein coronas differ in composition, deformability and dynamics from those of hard particles, as material properties influence protein binding.

To study these processes under body-like conditions, a team led by Oya Tagit, a professor at the FHNW School of Life Sciences, developed an artificial venous circulation system. This system simulates shear forces, the constant movement of nanoparticles and a continuous exchange of proteins—mimicking the natural bloodstream.

The study has been published in the journal *Advanced Materials Interfaces*.

Cell uptake drops with corona

In experiments with lung cancer cells, the researchers found that the uptake of nanoparticles into cells was significantly reduced by their protein corona. "The protein corona alters the properties of the nanoparticles—depending on the material being studied," explains Anamarija Nikoletić, first author and Ph.D. student at the SNI Ph.D. School.

"While all the nanoparticles we examined had a common core of proteins in their corona, they also exhibited material-specific differences."

Lipid particles show added interactions

Another interesting observation was that lipid-based nanoparticles interacted not only with soluble proteins but also with membrane-associated proteins. This suggests that, during circulation, these nanoparticles may interact or even fuse with cell-secreted extracellular vesicles, further altering their biological identity.

"This study highlights how crucial it is to test nanoparticles under realistic conditions to better understand their behavior in the body. This will help us develop safer and more effective drug delivery systems," Tagit emphasizes.

More information: Anamarija Nikoletić et al, Protein Corona Formation on Soft Nanocarriers Under Biomimetic Circulatory Flow, *Advanced Materials Interfaces* (2026). DOI: 10.1002/admi.70611

Provided by University of Basel