DNA nanostructures get camouflaged by proteins

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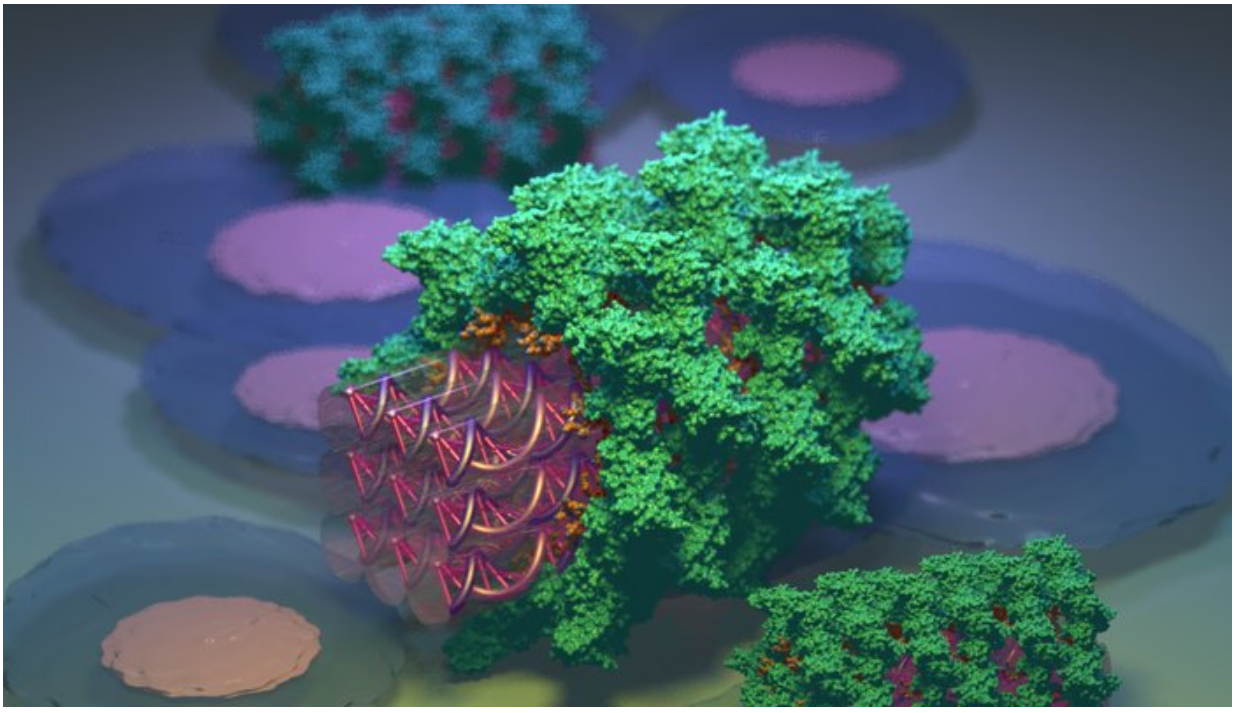

DNA nanostructures (purple) get camouflaged by serum albumin proteins (green). Credit: Veikko Linko and Mauri Kostiainen

Researchers from Aalto University and Helsinki University have reported a strategy that significantly increases the stability of DNA nanostructures against DNA digesting enzymes, enhances delivery rates and, most importantly, suppresses DNA-induced immune response.

"The hypothesis is based on coating the DNA structures by inert proteins, namely serum albumins, with the help of a synthetic DNA-binding domain that is covalently linked to the protein", explains Adjunct Professor Veikko Linko from Aalto University. The strategy was that as the DNA nanostructure – in this study a brick-like DNA origami – is negatively charged, the positively charged multivalent binding domain (dendron) can attach to the surface of the DNA object through electrostatic interactions. By adjusting the binding efficiency and the amount of protein-dendron conjugates used for coating, it was possible to form a dense and uniform protein corona around the DNA origami. The study showed that the immune system can be 'bluffed' when the DNA nanostructures are camouflaged by proteins as the protein-coated DNA structures efficiently attenuated the activation of immune response determined from mouse primary spleen cells.

"The reported coating strategy is straightforward and it is not limited to serum albumin proteins, but is essentially modular, as one can link almost any protein to the designer synthetic DNA-binding domain" adds Professor Mauri Kostiainen, who led the collaborative research. Therefore, the proposed technique enable other researchers to tune the surface properties of DNA nanostructures in biological environment in desired ways. Serum albumin is the most abundant protein in the blood with a long circulation half-life, and thus it has already found clinically approved implementations in drug delivery. Therefore, the authors envision that the presented system will open up new opportunities in tailored DNA-based drug delivery.

This study was reported in *Advanced Healthcare Materials*, volume 6, issue 18 (September 20, 2017) and highlighted as the cover art and in *Advanced Science News*.

More information: Henni Auvinen et al. Protein Coating of DNA Nanostructures for Enhanced Stability and Immunocompatibility,

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