Nanovesicles in predictable shapes

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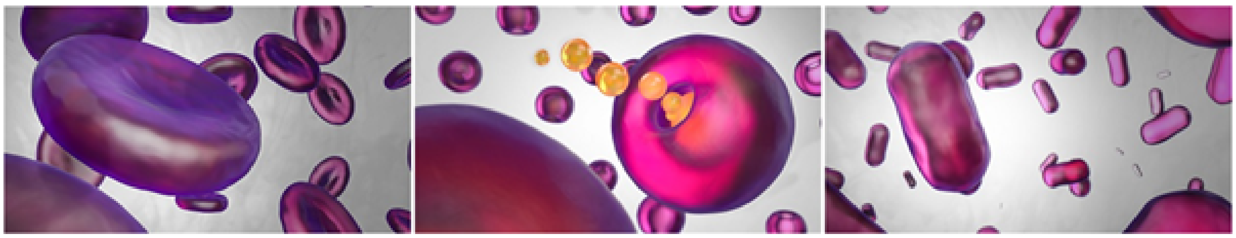

Figure 1. Shape transformation of the nanovesicles: disks (left), bowl shaped stomatocytes (middle) and rods (right). The vesicles have a typical size of 500 nanometres. All figures are also available in a large format. Credit: Radboud University

Beads, disks, bowls and rods: scientists at Radboud University have demonstrated the first methodological approach to control the shapes of nanovesicles. This opens doors for the use of nanovesicles in biomedical applications, such as drug delivery in the body. *Nature Communications* will publish these results on 25 August.

The shape of nanovesicles – called 'polymersomes' in jargon – in a solution varies at different compositions of that solution, scientist Roger Rikken and his colleagues at Radboud University discovered. "Besides the spherical shapes, we can create disks, rods, and bowl shaped stomatocytes by varying the ratio of the solvent. This regulates the osmotic pressure and permeability of the vesicles, controlling their deflation and subsequent re-inflation," Rikken explains.

For the first time, the shape of the nanovesicles is now fully controllable and predictable. This offers possibilities to transform and mould the vesicles into nanocontainers or nanorockets, which are highly desirable, e.g. for drug delivery in the body. The shape of the polymersomes also affects their flow properties, as is also believed to be the case for red blood cells. It is therefore of great importance to obtain full control over shape transformations to utilise vesicles in drug transport via the blood stream.

By using the magnets of the High Field Magnet Laboratory, Rikken was able to determine the exact shape of the vesicles at every solvent ratio. Subsequently, he studied the variety of shapes with electron microscopy and described them mathematically. In this way, he discovered that the shape transformation follows the path of the lowest energy. "Nature is always trying to stay in balance. The four shapes that we found turn out to be located exactly at the energy minima in an existing model. The basic idea behind our discovery is actually very logical, but it was never described before."

More information: R. S. M. Rikken et al. Shaping polymersomes into predictable morphologies via out-of-equilibrium self-assembly, *Nature Communications* (2016). DOI: 10.1038/ncomms12606

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