

414h Long-Circulating Cylinder Micelles Demonstrate Strong Effects of Morphology on Biological Transport

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Morphologies of natural vehicles such as viruses and pollen grains range from quasi-spherical to filamentous, and raise fundamental questions about the effects of vehicle shape on biological transport and interactions. With a diverse set of copolymer-based assemblies, we decouple the effects of chemistry from morphology and elucidate the biological impact of cylinder shape and length. Compared to spherical morphologies made from similar copolymers, microns-long cylindrical micelles – termed flexicelles here – exploit hydrodynamics and minimize capture by cells. These cylindrical vehicles are readily loaded with hydrophobic dyes or drugs and are found to circulate through the microvasculature for more than a week after injection. This is far longer than the tens of hours (or less) widely described for typical viruses and synthetic vehicles such as liposomes. While the protracted circulation and length-dependent interactions of flexicelles open up a myriad of applications, the results also provide broad insight into what is ‘nano’ in biological systems.