Tom Edwardson comes from the North-East of Scotland and studied chemistry at the University of Edinburgh, obtaining his MChem in 2008. In 2015, he completed a PhD in Chemistry at McGill University with Prof. Hanadi Sleiman, where he worked on DNA nanotechnology. Tom is currently an HFSP postdoctoral fellow at the ETH Zurich with Prof. Donald Hilvert, where he is developing protein cage engineering towards applications in biology and medicine.

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MIMICKING NATURE'S NANOCOMPARTMENTS THROUGH PROTEIN CAGE ENGINEERING

TOM EDWARDSON
Department of Chemistry and Applied Biosciences
ETH Zurich

Well-defined containers constructed from multiple protein subunits are a unique class of nanomaterial relevant from the perspective of both supramolecular chemistry and biology. These protein cages are widespread in nature, where they are responsible for a diversity of important tasks. As such, producing our own designer protein cages, complete with bespoke functionalities, is a promising avenue to new biotechnology and medicine. In this talk, I’ll describe how an artificial, computationally designed protein cage, can be rationally engineered using supramolecular intuition to produce new functional capsules. Exploiting electrostatically-driven self-assembly, positive supercharging of the interior cavity of this porous protein cage enables the efficient encapsulation of oligonucleotides. Moreover, these cargo-loaded cages enter mammalian cells and disperse their functional siRNA cargo to modulate gene expression. To expand the cargo scope of this proteinaceous container, a higher level of supramolecular complexity is introduced. Encapsulation of anionic surfactants affords protein-scaffolded micelles, which are capable of sequestering poorly water soluble small molecules within their hydrophobic cores. Further development of these genetically-encoded materials is ongoing towards specific applications ranging from cell biology to new therapies.