PROTEIN AND DNA ASSEMBLIES AT MEMBRANE INTERFACES

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Protein are remarkable biomolecular buildings blocks because their amino acid sequences allow for many shapes and geometries to be engineered. Yet the very flexibility of protein chains makes predictable folding and assembly a task that currently sits at the limit of current approaches for rational design.

By contrast, DNA offers almost total predictability. The specificity of DNA base pairing allows the construction and assembly of defined architectures from more rigid subunits that can be designed in advance. The subunits can be rapidly prepared using standard DNA laboratory equipment, and self-assembled into functional nanomaterials.

In my talk, I will compare the use of protein versus DNA building blocks as components for an important class of self-assembled nanomaterials: Nanopores. These designed constructs punch nanoscale holes across the semifluid biological membranes. In doing so, these water-filled nanopores allow controlled transport of ions or molecules across the otherwise impermeable barrier. I will show the relative strength of using protein and DNA to design nanopores, and highlight their use in a wide range of applications including biosensing, portable genetic sequencing, drug-delivery, cell killing, and the creation of synthetic cell-like structures. My presentation will conclude with the description of a training programme to improve the interdisciplinary breadth and depth of research groups.

Keywords: DNA, Protein, Membrane

References:

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