

Creating artificial Structures with Proteins (and DNA)

Jonathan Heddle

Heddle Initiative Research Unit, RIKEN, 2-1, Hirosawa, Wako, Saitama 351-0198,
Japan. E-mail: heddle@riken.jp

It is desirable to make many material structures with nanoscale dimensions and in a way in which the exact structure can be designed and controlled. Such structures can have valuable properties in catalysis, and energy production and storage depending on the materials used. A major challenge however is how to build such small structures. A top-down approach of maneuvering atom-by atom is not practicable and chemical processes do not allow easy control of fine structure and may be energy intensive and use materials toxic to the environment. A possible solution to these problems lies in the field of bionanoscience. Here the unique abilities of biological molecules such as proteins and DNA are used. These molecules have precise nanoscale structures and do not have to be built – they build themselves! (Self-assembly). We are interested in designing and building new, complex structures from these molecules. I will show the process and examples of how we designed such structures including self-assembled protein nanotubes, protein cages that resemble virus capsids and DNA origami-based structures. Potential applications as smart medicines and components of biological “nanorobots” will also be discussed.