Designing biomolecular devices and machines

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Inspired by the rich functionalities of natural macromolecular assemblies such as enzymes, molecular motors, and viruses, we investigate how to build increasingly complex molecular structures. Our goal is to build molecular devices and machines that can execute a variety of user defined tasks, ranging from the positioning and processing of other molecules to drug delivery. A central obstacle in our work is the difficulty of constructing complex and accurate molecular structures. Another problem relates to an insufficient understanding of the mechanisms necessary to achieve a desired function. Currently we mainly focus on molecular self-assembly with DNA to build de novo structures. DNA origami in particular enables building nanodevices that can already be employed for making new discoveries in biomolecular physics and protein science. In the longer term we hope to contribute to the creation of molecular machines and systems that have practical benefits for everyday life through uses in medicine – for diagnosis and therapy – and synthetic enzymes for biologically inspired chemistry.

References

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