Designing biomolecular devices and machines

Abstract:

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.

Prof. Dr. Hendrik Dietz graduated in physics from the Ludwig-Maximilians-Universität München (LMU) and subsequently did his doctorate in the field of biophysics at the Technische Universität München. After a two-year research post as a postdoc at Harvard Medical School, he returned to TUM in 2009 as associate professor. Since 2014 he is a full professor and head of the TUM Laboratory of Biomolecular Design. For his research Dietz received several awards, among them the Gottfried Wilhelm Leibniz Prize of the Deutsche Forschungsgemeinschaft.

Recent publications:

K. Wagenbauer, C. Sigl, and H. Dietz: "Gigadalton-scale shape-programmable DNA assemblies", NATURE 2017

F. Praetorius, B. Kick, K. Behler, M. Honemann, D. Weuster-Botz, and H. Dietz: "Biotechnological mass production of DNA origami", NATURE 2017

F. Praetorius and H. Dietz: "Self-assembly of genetically encoded DNA-protein hybrid nanoscale shapes", SCIENCE 2017

F. Kilchherr, C. Wachauf, B. Pelz, M. Rief, M. Zacharias, H. Dietz: "Single-molecule dissection of stacking forces in DNA", SCIENCE 2016

T. Gerling, K. Wagenbauer, A. Neuner, H. Dietz: "Dynamic DNA devices and assemblies formed by shape-complementary, non-base pairing 3D components", SCIENCE 2015