Triangulated DNA Trusses

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Amongst the possible geometries which can be constructed using DNA origami [1,2] triangulated wireframe structures are getting increasing attention [3,4].
Being sufficiently stiff, these structures can span an extraordinary volume and tolerate assembly in physiological buffer conditions [4]. We seek to explore the properties and potential of a subclass of this structures, consisting of multiple joined polyhedra having just a single DNA helix per edge. A custom written software allows the design of a basic flat structure. From this template tubular assemblies consisting of joined polyhedra such as tetrahedra, octahedra or irregular dodecahedra can be formed by means of exchanging a few connector staples [5].
While providing a uniform mesh (which might be important for biophysical studies), these structures have defined cavities with regular spacing which is important for construction of enzyme cascades and plasmonic structures.

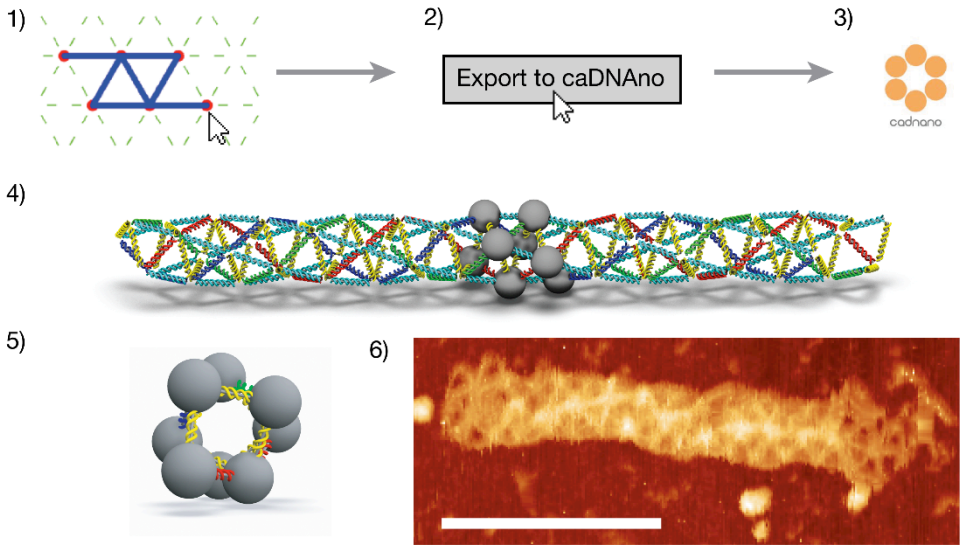

Fig. 1: 1) Design of the scaffold path is performed in a custom written software. 2-3) The design is exported to caDNAno [2], where it is further modified. 4) vHelix model [4] of an irregular dodecahedral truss, generative polyhedra is marked by gray spheres. 5) cross section of the truss at the generative polyhedron. 6) AFM micrograph of the dodecahedral truss, scale bar 100 nm

[1] P.W.K. Rothemund Nature 2006;
[2] S. Douglas et al. Nature 2009.
[3] Zhang et al. Nat. Nanotechnol. 2015.
[4] Benson et al. Nature 2015.
[5] Matthies et al., Nano Letters 2016