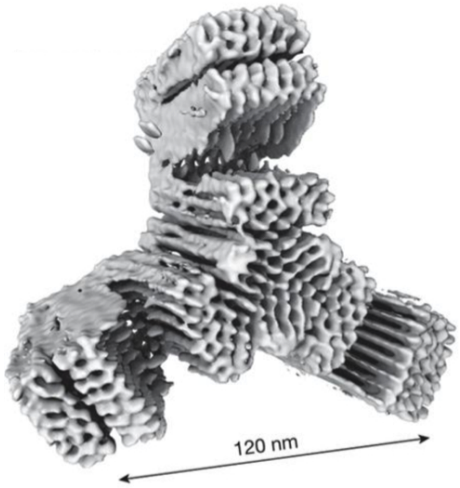
Self-assembly in space and time

(theoretical & numerical internship, possibly leading to a thesis)

Recent experimental developments have made assembling machines at the nanometer scales that mimic or even attempt to surpass the functions of biological objects an increasingly reasonable goal (as recognized in 2016). Despite remarkable progress in manufacturing individual nanometer-sized objects with controlled shapes however (see an example in the illustration), assembling many of them into larger structures remains an open challenge and an active field of research.

In this project we will undertake an additional challenge, namely to **self-assemble such objects not only in *space*, but also in *time***. Specifically, we will explore the design principles for DNA origami particles produced by our collaborator Seth Fraden (Brandeis University, USA) to assemble over a given sequence over time, which will allow for an actin-like treadmilling (coordinated polymerization from one end, depolymerization from the other) of a polymer-like structure under e.g., temperature cycling. Such mechanisms could be key in controlling the motor action of prospective molecular machines.

In a second stage (e.g., during a PhD), the intern may develop simulations tools to optimize particle shapes for self-assembly of printed particles produced at PMMH in collaboration with Julien Heuvingh and Olivia du Roure.



Example of a complex rigid structure manufactured using DNA origami (Wagenbauer, Nature 2017).

Expected skills:
A taste for statistical mechanics, numerical simulations and working with experimentalists.

Location:
PMMH at ESPCI & Sorbonne U. and/or LPTMS at U. Paris-Saclay (Orsay)

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