Structural Stability of DNA Origami Nanostructures in the Presence of Chaotropic Agents

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DNA origami [1] is an emerging powerful platform for single-molecule investigations of biomolecular processes [2]. The required structural integrity of the DNA origami may, however, pose significant limitations regarding their applicability, for instance in protein folding studies that require strongly denaturing conditions [3]. Here, we report a detailed study on the stability of 2D DNA origami triangles in the presence of the strong chaotropic denaturing agents urea and guanidinium chloride (GdmCl), in dependence of concentration and temperature. At room temperature, the DNA origami triangles are stable in both denaturants at concentrations as high as 6 M (Figure1). At this denaturant concentration, denaturation of the DNA origami nanostructures is observed already at 30°C, i.e. below their original melting temperature. This agrees with the well-known chaotrope-induced reduction of DNA melting temperature [4]. However, we find that structural integrity of the DNA origami is governed by variations in melting temperature of the individual staple strands. The global melting temperature of the DNA origami does therefore not represent an accurate measure of their structural stability. By rational design of individual staple strands used for the folding of a particular shape, the structural stability of DNA origami may be tailored toward specific experimental requirements.

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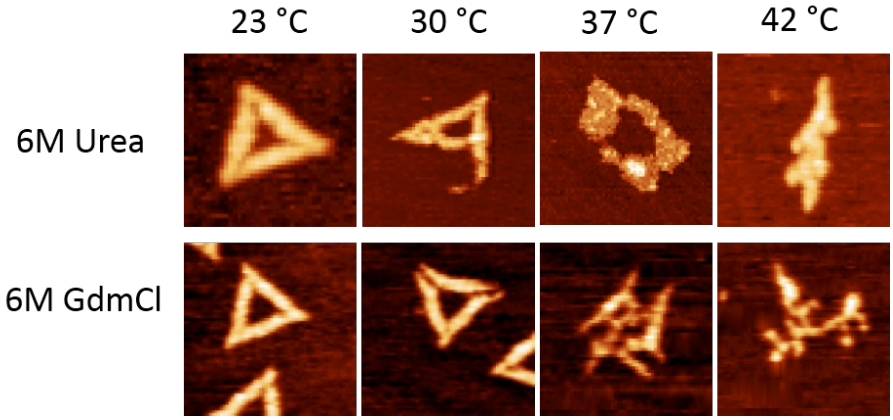

Figure 1. DNA origami triangles after 1h incubation in 6M urea and GdmCl at different temperatures

[1] *Rothemund et al. Nature (2006)* ***440****, 297.*
[2] *Bald and Keller, Molecules (2014)* ***19****, 13803.*
[3] *Rashid et al., Protein J. (2005)* ***24****, 283*
[4] *Hutton, Nucleic Acids Res. (1977)* ***4****, 3537.*