Spatiotemporal control in supramolecular polymers in water;
Lessons learned from Professor Jan Engberts

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Self-assembly and self-organization in water is obvious for natural systems, but turns out to be much more difficult for artificial systems. In the lecture we will focus on water as the magic solvent for contolling supramolecular architectures. Examples of our work are selected where the lessons learned from Professor Jan Engberts are used by us to obtain a better understanding of the self-assembly in water.

Firstly, we will present the non-covalent synthesis of a multi-component supramolecular polymer in which chemically distinct monomers spontaneously co-assemble into a dynamic, functional structure in water. We show that a multivalent recruiter is able to bind selectively to one subset of monomers (receptors) and trigger their clustering along the self-assembled polymer; behavior that mimics raft formation in cell membranes. This phenomenon is reversible and affords spatiotemporal control over the monomer distribution inside the supramolecular polymer by super-selective binding of single-strand DNA to positively charged receptors.

Secondly, the diversity in protein structures and the complexity of the processes involved make studies to folding and assembly of proteins challenging research objectives. A number of simple artificial structures will be introduced that are studied in great detail for their self-assembly and folding processes in water. Meta-stable folded single-chain macromolecules will be used as a catalyst. An attempt will be made to elucidate the differences and similarities between these simple artificial structures and complex proteins to arrive at a few general statements on folding and assembly of (macro)molecules in water.