

Self-activated self-assembly via the retro-thio-Michael reaction and its potential to develop in situ artificial organelles

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At its core, life is a kinetic process enabled by thermodynamic gradients. Thus, in order to construct artificial life, it is essential to develop the tools to gain temporal control over synthetic supramolecular systems. Our work with deoxyguanosine (G) derivatives has led to the discovery of supramolecular systems whose self-assembly is driven by hydrophobic interactions. One such G-derivative having a strategically localized none is modified with a thiol like 2-mercaptoethanesulfonate (Coenzyme M) via a thio-Michael reaction to form a highly hydrophilic derivative, G^* , whose hydrophobicity lies below the self-assembling threshold keeping it in disassembled state. Addition of a variety of thiol-scavengers promote a retro-thio-Michael reaction that shifts the equilibrium back to the initial G-derivative, which undergoes a spontaneous self-assembly with a delayed onset of formation (i.e., temporal control). The current timescales for the onset of self-assembly ranges from 18–203 minutes making this strategy a very versatile one. Considering the biocompatibility of the components used in these studies, this strategy should enable the development of new tools to interrogate time dependent phenomena in cell biology studies.