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Probing the Mechanism of Self-Reproducing Micelles

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Introduction: Surfactants are widely agreed to have played an important role in the emergence of life on Earth. Surfactant aggregates such as micelles and vesicles can catalyse reactions, compartmentalise and concentrate reagents, and self-reproduce.[1] These physical and chemical processes could have played a key role in the transformation of non-living matter to the first cellular forms of life. A key mechanism for the self-reproduction of surfactant aggregates is physical autocatalysis (Fig. 1). Here a micelle or vesicle catalyses the formation of more surfactant molecules in a biphasic system by facilitating the mixing of the two phases and in doing so drives its own reproduction.[2]

A novel autocatalytic reaction: The range of reactions currently known to proceed via physical autocatalysis is very limited and examples where physical autocatalysis is driven by bond forming transformations are even more scarce.[3] Reactions where molecular complexity increases by forming new bonds must have played an important role in prebiotic synthesis. The work presented here describes a novel physical autocatalytic reaction where new bonds are formed via a copper-catalysed azide-alkyne cycloaddition. We discuss in-depth mechanistic studies of this system and the scope and the limitations of the reaction.

References: [1] P. Walde (2006) *Origins of Life and Evolution of Biospheres*, 36:109–150. [2] A. J. Bissette, S. P. Fletcher (2015) *Origins of Life and Evolution of Biospheres*, 45:21–30. [3] A. J. Bissette, B. Odell, S. P. Fletcher (2014) *Nature Communications* 5:1–8.

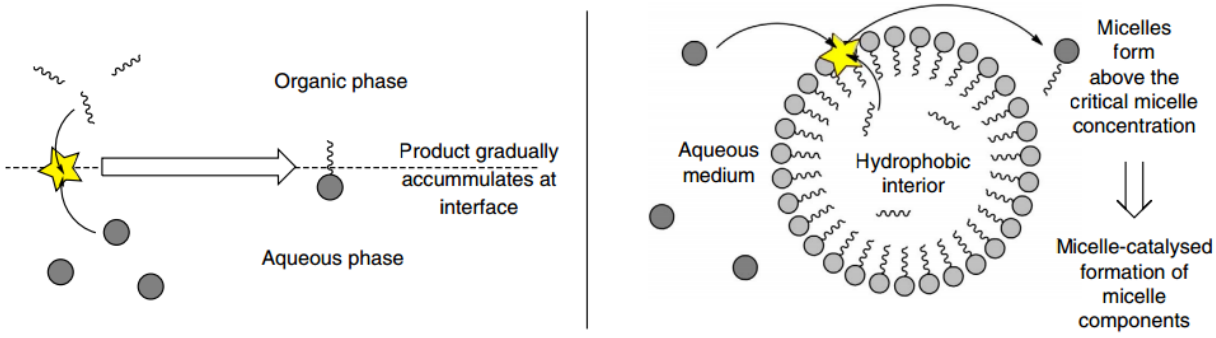

Figure 1 – Schematic representation of physical autocatalysis.[3] Left: Surfactant is slowly generated at the interface during a lag period. Right: The surfactants aggregate once the critical micelle concentration is reached and the resulting micelle starts to catalyse the reaction.