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Physical autocatalysis triggered by a transition metal-catalyzed reaction.

I. Colomer[1] and S. P. Fletcher[1]
[1] Department of Chemistry, Chemistry Research Laboratory, University of Oxford, Mansfield Road, Oxford OX1 3TA, United Kingdom
* ignacio.colomerutrera@chem.ox.ac.uk

Introduction: Assuming general consensus that a living organism must possess genetic mechanism, metabolic machinery and a cell membrane,[1] revealing simple structures that meet this criteria will help to understand the orgin of life. Amphiphilic molecules, bearing both hydrophilic and hydrophobic components (Figure 1), represent key intermediates in the origin of life and chemical evolution. They can self-assemble into ordered structures, such as micelles or lipid bilayers, due to their amphiphilic nature. All, micelles, bilayers and vesicles represent primary models for protocell membrane. Moreover modification of these protocell membranes, such in the fatty acylation of peptides and proteins is associated with metabolic regulation processes. Uncovering new autocatalytic pathways, as well as understanding their aggregate dynamics and interaction with other macromolecules, has recently attracted the attention of the scientific community.

Summary: It has been proposed that metals have played a crucial role in the oring of life.[2] We highlight here the importance of merging transition metal-catalyzed reactions and new modes of autoinduction[3] or physical autocatalysis,[4] using simple non-activated molecules, such as alkenes. Our goal is also to uncover new pathways to incorporate important biomolecules (such as sugars, amino acids or small peptides) into these amphiphilic structures, with special interest in autoinductive mechanisms, where the product of the reaction will self-assemble (Figure 1), accelerating the rate of the reaction (ie. by means of the formation of complex dynamic systems, encapsulation or phase transfer catalysis).

References:

[1] Kepa RM et al. (2014) *Chemical Reviews*, 114:285-366. [2] Luca B and Sheref SM (2016) *Elements*, 12:413-418. [3] Donna GB (2009) *Angewandte Chemie Internatonal Edition*, 48:386-390. [4] Andrew JB and Stephen PF (2013) *Angewandte Chemie Internatonal Edition*, 52:12800-12826.

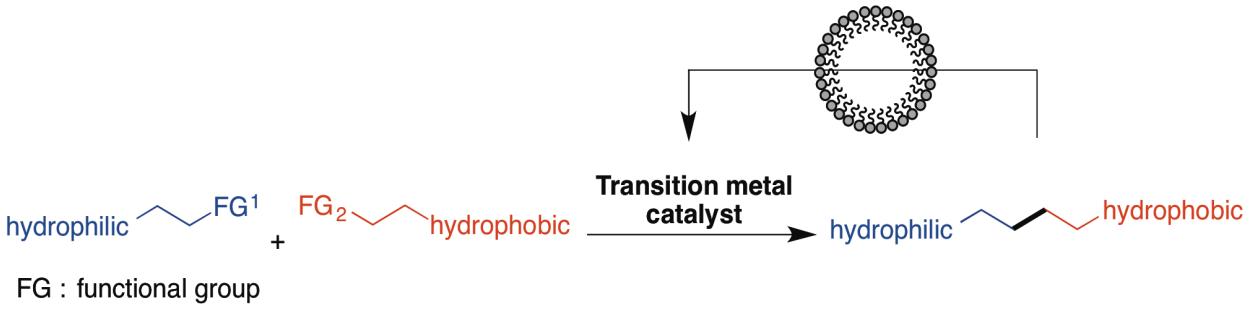

Figure 1 – Schematic summary of the transition metal-catalyzed autocatalytic reaction.