



EPSC Abstracts

Vol. 16, EPSC2022-254, 2022, updated on 02 Jun 2023

<https://doi.org/10.5194/epsc2022-254>

Europlanet Science Congress 2022

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## **From a Homogeneous Non-biochemical Soup to the Emergence of Fundamental Functions of Life, including Adaptation. Physics and Chemistry Working Together at micron scales**

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Experimental progress made during the last decade in dynamical self-assembly and its chemical implementation can be used to provide experimental examples of biochemistry-free autopoietic systems that emerge from homogeneous and isotropic solutions under selected environmental conditions. These simple emergent vesicular structures and systems self-assemble and, then in aqueous media, using conformational information, metabolize, self-reproduce, compete and evolve by adaptive or non-adaptive means. They also are chemo and phototactic. These systems can be implemented in the chemistry laboratory. They can be thought of as very primitive proto-cellular systems capable of evolving. Their information handling and metabolism use RAFT (Reversible Addition Fragmentation Transfer) polymerization chemistry, their reproduction is by sporular seeds and results from the combination of both environment induced degradation and hydrodynamic instability of the autonomously created amphiphiles and their metastable self-assembled membranes. Their evolution involves the adaptive interaction between environment, population and the feedback loops between the two highly selective chemistries that are combined in the system: "click chemistry" and (RAFT) polymerization induced self-assembly.