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# Exploring Proto-cytoplasmic Media. Self-Assembly and Molecular Diffusion in Salt-Hydrogel Phases

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## Abstract

In attempting to understand the emergence of biological life, both top-down and bottom-up approaches aim to converge at some primitive cellular system. As part of this, amphiphilic and polymeric molecules are widely recognised as being important.<sup>1</sup> However, what may have been less widely recognised is that a cellular cytoplasm is not just an aqueous salt solution but a hydrogel environment. Indeed, Trevors and Pollack had realised the potential importance of hydrogels to life emergence in 2005, arguing that "a primitive hydrogel was a more suitable environment for the assembly of pre-cells, and ultimately cells capable of growth and division".<sup>2,3</sup>

Therefore, we have been examining hydrogel environments which may have been plausible within the early earth Haden period, such as silica and lamellar clay hydrogels. Within these forms of geologically-relevant hydrogels, we have been investigating fundamental processes which themselves might have been considered as relevant within prebiotic environments; such as amphiphilic self-assembly and molecular diffusion.

In this paper, we discuss our early results, many of them as yet unpublished, on the measurements of critical micelle concentrations of representative amphiphiles in the salt-hydrogel phase and comparing them to aqueous. In addition, we will present our preliminary studies on measuring diffusional coefficients using DOSY spectroscopy directly in the hydrogel phase and again comparing them to aqueous.

1. A. Pohorille and D. Deamer, *Research in Microbiology*, 2009, 160, 449-456.
2. J. T. Trevors and G. H. Pollack, *Progress in biophysics and molecular biology*, 2005, 89, 1-8.
3. G. N. Ling, *Life at the cell and below-cell level: The hidden history of a fundamental revolution in biology*, Pacific Press New York, NY, USA:, 2001.

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