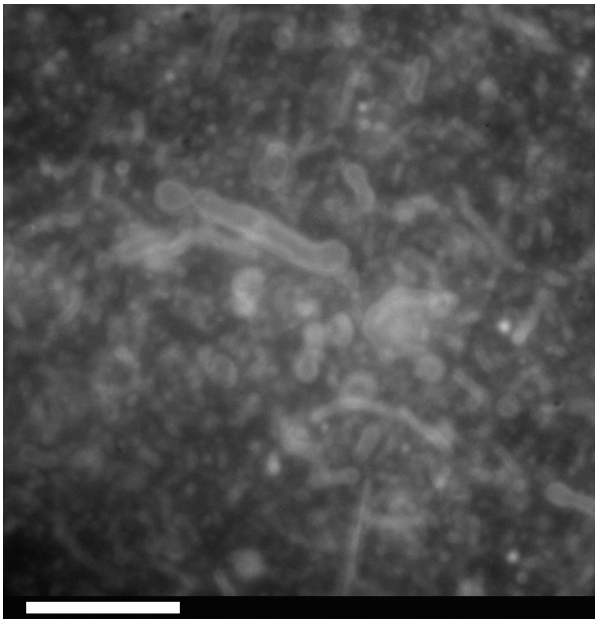
Vesicle Formation Under Ocean-like Conditions from Prebiotically Plausible Amphiphiles. S. E. Maurer[1] and P-A. Monnard[2] and M. Hanczyc[3], [1]Central Connecticut State University (Department of Chemistry and Biochemistry, smaurer@ccsu.edu), [2]University of Southern Denmark (Department of Physics, Chemistry and Pharmacy, monnard@sdu.dk) [3]Università degli Studi di Trento (Center for Integrative Biology, Italy, martin.hanczyc@unitn.it).

Introduction: The environment in which life arose is the subject of much speculation. One of the main arguments for fresh water is that membranes are not stable in ocean water, especially simple prebiotic membranes like those composed of fatty acids. However, oceanic hydrothermal vents and hydrothermal fields offer a unique aqueous environment that has many synthetic advantages over surface fresh water, leading to their frequent suggestion as a environment for abiogenesis.

This research is focused on generating membranes in ocean-like solutions from prebiotic molecules specifically, mixtures of amphiphiles that are more stable under these ionic strengths than pure amphiphile suspensions. Mixtures of decylamine, decanoic acid, glycerol monodecanoate, decanol, and/or decylsulfate were explored for membrane formation in ocean-like solutions (35 g/L sea salt). Temperature and pH were also varied in these mixtures to find sets of conditions that generated stable membranes.

In general, binary mixtures of charged and neutral amphiphiles were more likely to form membranes under any conditions than neutral mixtures or charged mixtures. We confirm that divalent cations precipitate membranes containing decanoate (deprotonated decanoic acid), however below the pKa of the acid precipitation does not occur. Several sets of environmental conditions are available where membranes composed of simple amphiphiles can be found. At low and neutral pH (~2 and 7), decylamine mixed with neutral amphiphiles often generates membrane in sea salt solutions. At neutral pH, decylsulfate with glycerol monodecanoate also seems to form membranes. At high pH (10), glycerol monodecanoate alone and mixtures of decylsulfate and decanol show membranous structures. These results suggest that membrane formation can occur in a variety of environments depending on amphiphile composition.



Decanoic acid/decylamine membranes. Fluorescence micrograph of membranes in 10 mM HCl, 35 g/L sea salt at ~50 °C. Scale bar is 25 μm.