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Unusually large unit cell of lipid bicontinuous cubic phase: towards nature's length scales[1] HOJUN KIM, CECILIA LEAL, University of Illinois at Urbana-Champaign — Lipid bicontinuous cubic phases are of great interest for drug delivery, protein crystallization, biosensing, and templates for directing hard material assembly. Structural modulations of lipid mesophases regarding phase identity and unit cell size are often necessary to augment loading and gain pore size control. One important example is the need for unit cells large enough to guide the crystallization of bigger proteins without distortion of the templating phase. In nature, bicontinuous cubic constructs achieve unit cell dimensions as high as 300 nm. However, the largest unit cell of lipid mesophases synthesized in the lab is an order of magnitude lower. In fact, it has been predicted theoretically that lipid bicontinuous cubic phases of unit cell dimensions exceeding 30 nm could not exist, as high membrane fluctuations would damp liquid crystalline order. Here we report non-equilibrium assembly methods of synthesizing metastable bicontinuous cubic phases with unit cell dimensions as high as 70 nm. The phases are stable for very long periods and become increasingly ordered as time goes by without changes to unit cell dimensions.

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