

Pure Protein Bilayers and Vesicles from Native Fungal Hydrophobins

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Abstract

In this study, a microfluidic approach to generate free-standing, protein bilayers and protein vesicles is presented. These are composed solely of the hydrophobin HFBI, which is a small, amphiphilic protein produced by filamentous fungi. Their amphiphilicity allows the proteins to self-assemble at any hydrophilic/hydrophobic interface in very stable monolayers. These monolayers are used to generate free-standing bilayers. Employing different fluids in a microfluidic setup, the stability of bilayers in both possible orientations (i.e. in the hydrophilic or hydrophobic contact situation) is demonstrated.

This allows the creation of hydrophobin membranes between either aqueous, oily, or gaseous compartments. These membranes are then used to produce aqueous, oily or gaseous hydrophobin vesicles by means of the microfluidic jetting technique. The resulting lipid-free vesicles are the first example of vesicles only composed of proteins. With the insertion of functioning gramicidin pores, the foundation for employing these vesicles as a new experimental class of encapsulating platform in synthetic biology is laid.

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