

## A 3-D hexagonal inverse micellar lyotropic phase

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A number of complex three-dimensional lyotropic liquid crystal phases are already known, such as the bicontinuous cubic phases, but so far only a single example has been found – a cubic phase of spacegroup  $Fd\bar{3}m$  – of a structure based upon a complex close packing of inverse micelles (1). We now report the discovery (2) of a novel lyotropic liquid crystal phase, of space group,  $P6_3/mmc$ , whose structure is based upon a hexagonal close packing of identical quasi-spherical inverse micelles (Figure 1). The model membrane system consists of a hydrated mixture of dioleoylphosphatidylcholine, dioleoylglycerol, and cholesterol. This novel phase has a number of unique features which may render it useful for a wide range of applications. Firstly, it is the only known self-assembled lyotropic phase whose structure consists of a *periodic close packing of identical inverse micelles*. Secondly, it is stable in *excess aqueous solution*, which is very important for potential biological or biomedical applications.

### References

- (1) V. Luzzati, V., R. Vargas, A. Gulik, P. Mariani, J.M. Seddon, and E. Rivas, *Biochemistry* **31**, 279-285 (1992).  
 (2) G. C. Shearman, A. I. I. Tyler, N. J. Brooks, R. H. Templer, O. Ces, R. V. Law and J. M. Seddon *J. Am. Chem. Soc.* **2009**, *131*, 1678

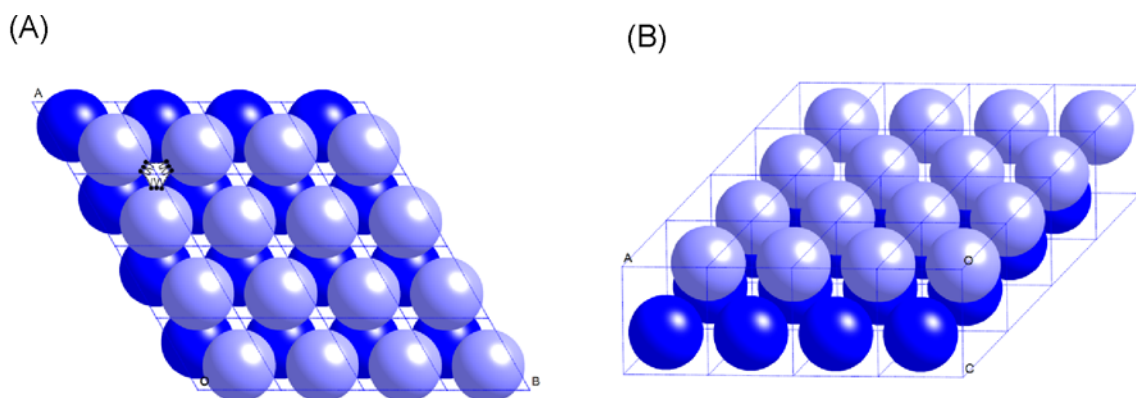


Figure 1. Plan (A) and perspective (B) views of the schematic structure, which consists of an hcp packing of identical quasi-spherical inverse micelles. The identical water cores have diameters in the region of 20 – 25 Å. The different colour shading of the two identical layers is simply for clarity.