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# Phase-separation in Gram-negative bacterial outer membranes

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Gram-negative bacteria are surrounded by a protective outer membrane with phospholipids in its inner leaflet and lipopolysaccharides (LPS) in its outer leaflet. The outer membrane is also populated with many  $\beta$ -barrel outer-membrane proteins (OMPs), some of which have been shown to cluster into supramolecular assemblies. Using atomic force microscopy on living bacteria, we have shown that the outer membrane of *E. coli* is phase-separated into LPS-enriched and OMP-enriched domains, and that additional phases appear when the LPS-phospholipid asymmetry of the outer membrane is perturbed. I will discuss how we have discovered and characterised these phases, and conclude with an outlook how studies of nanoscale in-plane membrane heterogeneity may be complemented by neutron reflectometry for studying out-of-plane order in the membrane.

**Primary author:** Prof. HOOGENBOOM, Bart (University College London)

**Presenter:** Prof. HOOGENBOOM, Bart (University College London)