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Phase separation in model lipid membranes: physics and biophysics VERNITA GORDON, PAUL BEALES, MARKUS DESERNO, CAROLINE ANDREW, ZHIJUN ZHAO, STEFAN EGELHAAF, WILSON POON, School of Physics, SUPA, and COSMIC, University of Edinburgh — Lipids are biological amphiphiles that, in aqueous solution, self-assemble into a variety of structures, including bilayer membranes that form hollow vesicles. In membranes with two or more constituents, lipids are well-mixed when the temperature is sufficiently high. As the temperature is lowered, systems undergo ordering transitions, membranes phase-separate laterally, and the resulting domains pattern vesicles. Here we demonstrate different aspects of this patterning that are important both for basic science and for their technological potentials: the packings of lipids in ordered-phase domains determine the domains' morphologies and inclusivities; adherent regions of membranes favour the growth of ordered-phase domains; rapid phase separation forms many small stripe domains that pattern vesicles with a 'baseball' texture. These phenomena demonstrate basic physics and also have strong potential for exploitation to achieve vesicles with controllable patterns and properties. Lipid structures such as vesicles are attractive candidates for such technological development because they are intrinsicly biocompatible and because technologies using liposomes for controlled delivery and release are already widespread and under active development.

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