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Ordered bulk aggregates of lipid vesicles ANA HOCEVAR, Jozef Stefan Institute, PRIMOZ ZIHERL, Faculty of Mathematics and Physics, University of Ljubljana and Jozef Stefan Institute — We study the structure of bulk assemblies of identical lipid vesicles. In our model, each vesicle is represented as a convex polyhedron with flat faces, rounded edges, and rounded vertices. Each vesicle carries an elastic and an adhesion energy and it turns out that in the limit of strong adhesion, the minimal-energy shape of cells minimizes the weighted total edge length. We calculate the shape of the rounded edge exactly and show that it can be well described by a cylindrical surface. We compare several candidate space-filling polyhedra and we find that the oblate shapes are preferred over prolate shapes for all volume-to-surface ratios. We also study aggregates of vesicles whose adhesion strength on lateral faces is different from that on basal/apical faces. We determine the anisotropy needed to stabilize prolate shapes and we show that at any volume-to-surface ratio, the transition between the oblate and the prolate shapes is very sharp. We compare the geometry of the model vesicle aggregates with the shapes of cells in certain simple animal tissues. Predictions of our model are consistent with available experimental data.

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