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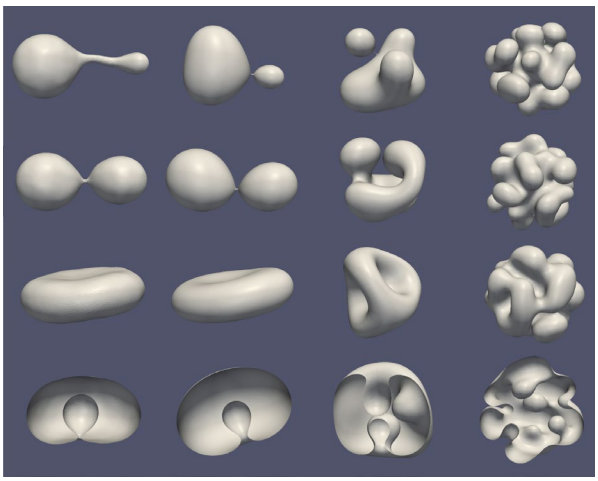
BIOPHYSICS

Droplet models of cells

On a simple physical level, a cell is a droplet that grows and divides. Modelling these processes can give insight into the formation of the first cells, which is not well understood. Writing in *Physical Review Letters*, Teresa Ruiz-Herrero and co-workers modelled the growth liquid drops enclosed within lipid membranes (vesicles) that emulate the shape of a developing cell. Their work complements other recent approaches that focus on the role of chemical reactions.



Ruiz-Herrero, T., Fai, T. G. and Mahadevan, L. (2019). Dynamics of growth and form in prebiotic vesicles, *Phys. Rev. Lett.*, American Physical Society **123**, 038102 (2019)

Ruiz-Herrero et al. upgrade an existing classical model — which includes energy terms associated with the stretching and bending of the membrane — with a term that accounts for the growth of the vesicle. Their approach recreates the stages of growth observed in synthetic lipid vesicles (pictured) and in L-forms — primitive wall-less bacteria — without requiring any biological or physico-chemical parameters, such as concentration gradients across the membrane or internal sources of lipids. Ruiz-Herrero et al. anticipate that including these aspects would be the next step in developing the model, which is currently unable to describe cell division.

In contrast to this purely mechanical approach, an earlier model developed by David Zwicker and co-workers considered cell growth and division using spherical, chemically active droplets formed by the phase separation of two liquids. These droplets grow and divide, driven solely by simplified chemical reactions within the droplet. Zwicker et al. studied the shape instability of these droplets and obtained sets of parameters — such as concentration, surface tension and chemical potential — that would accurately describe behaviour of protein colloids and thus reflect the relevance of the present approach to living systems.

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ORIGINAL ARTICLE Ruiz-Herrero, T., Fai, T. G. and Mahadevan, L. Dynamics of growth and form in prebiotic vesicles. *Phys. Rev. Lett.*, **123**, 038102 (2019)
FURTHER READING Zwicker, D. et al. Growth and division of active droplets provides a model for protocells. *Nat. Phys.* **13**, 408–413 (2017)