Professor Norbert Stoop

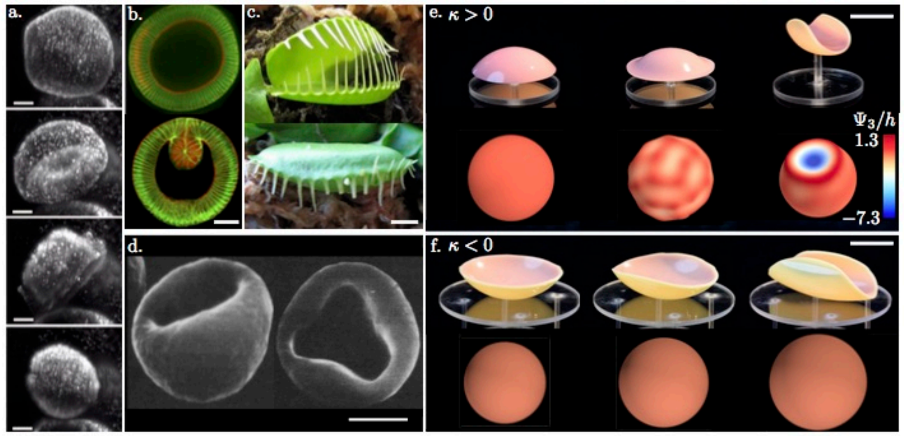

FIG. 1. Curvature-induced instabilities in shells. (a) The eversion of a *Volvox* embryo is triggered by variations in the local spontaneous curvature, from [11]. Scale bars represent 20 μm. (b) Similarly, the tissue folding in the *Drosophila* ventral furrow is induced by a natural curvature resulting from a multicellular myosin gradient, from [17]. Scale bar represents 20 μm. (c) The snap-through instability in the Venus flytrap is believed to be triggered by changes in the natural curvature of the leaf, the scale bar corresponds to 5 mm. (d) The different shapes of the red blood cells from the main stomatocyte-discocyte-echinocyte sequence (left) and a stomatocyte with triangular mouth (right) can be induced by natural curvatures, from [13]. The scale bar corresponds to 3 μm. (e) Instabilities in open (top sequence, experiments) and closed (bottom sequence, simulations) spherical shells triggered by a positive natural curvature. The closed shell buckles similar to the classical pressure buckling problem. Scale bar represents 3 cm. (f) Instabilities in open (top sequence, experiments) and closed (bottom sequence, simulations) spherical shells triggered by a negative natural curvature. The inflation of the closed shell is magnified by ten times and the simulation ends at the onset of large strains, since the shell model is built upon the assumptions of small strains. Scale bar represents 3 cm.

From: Matteo Pezzulla, Norbert Stoop, Mark P. Steranka, Abdikhalaq J. Bade and Douglas P. Holmes, "Curvature-induced instabilities of shells", Physical Review Letters, June 2017

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Research Interests:
Pattern formation in out-of-equilibrium systems; Nonlinear mechanics (thin rods, membranes); Numerical analysis; Collective dynamics and its description using generic, higher-order partial differential equations

Selected Publications:
Norbert Stoop, Falk K. Wittel, Martine Ben Amar, Martin Michael Müller and Hans J. Herrmann, "Self-contact and instabilities in the anisotropic growth of elastic membranes", Physics Review Letters, Vol. 105, 068101, August 2010
Vetter R, Stoop N, Jenni T, Wittel FK, Herrmann HJ (2013) Subdivision shell elements with anisotropic growth. International Journal of Numerical Methods in Engineering 95:791–810
Vetter R, Stoop N, Jenni T, Wittel FK, Herrmann HJ (2014) Simulating thin sheets: Buckling, wrinkling, folding and growth. In: Journal of Physics: Conference series, IOP Science, p 012012
Norbert Stoop, Romain Lagrange, Denis Terwagne, Pedro M. Reis & Jörn Dunkel, "Curvature-induced symmetry breaking determines elastic surface patterns", Nature Materials, Vol. 14, pp 337-342 (2015)
Norbert Stoop and Martin Michael Mueller, "Non-linear buckling and symmetry breaking of a soft elastic sheet sliding on a cylindrical substrate", International Journal of Non-Linear Mechanics, Vol. 75, pp 115-122, October 2015

Matteo Pezzulla, Norbert Stoop, Xin Jiang and D.P. Holmes, “Curvature-driven morphing of non-Euclidean shells”, Proceedings of the Royal Society A, Vol. 473, No. 2201, 31 May 2017
Matteo Pezzulla, Norbert Stoop, Mark P. Steranka, Abdikhalaq J. Bade and Douglas P. Holmes, “Curvature-induced instabilities of shells”, Physical Review Letters, June 2017