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Nonlinear Geometric Effects in Bioinspired Multistable Structures[1] ZI CHEN, Washington University in St. Louis, QIAOHANG GUO, Fuzhou University, KEVIN CHU, Serendipity Research, STEVEN SHILLIG, Virginia Technology, CHI LI, SUNY at Stonybrook, WENZHE CHEN, Fuzhou University, LARRY TABER, Washington University in St. Louis, DOUGLAS HOLMES, Virginia Technology — Nature features many thin shell structures with spontaneous curvatures, where mechanical instabilities play important roles in the morphogenesis and functioning of the organisms. However, the large deformation and instability phenomena of shells due to geometric nonlinearity, which often arise in morphogenesis and nanofabrication, remain incompletely understood. Here, we create spontaneously curved shapes with pre-strains in tabletop experiments, and study their instabilities with a minimal theory based on linear elasticity. The development of such theoretical and experimental approaches will promote quantitative understanding of the morphogenesis of growing soft tissues, and meet the emergent needs of designing stretchable electronics, artificial muscles and bio-inspired robots.

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