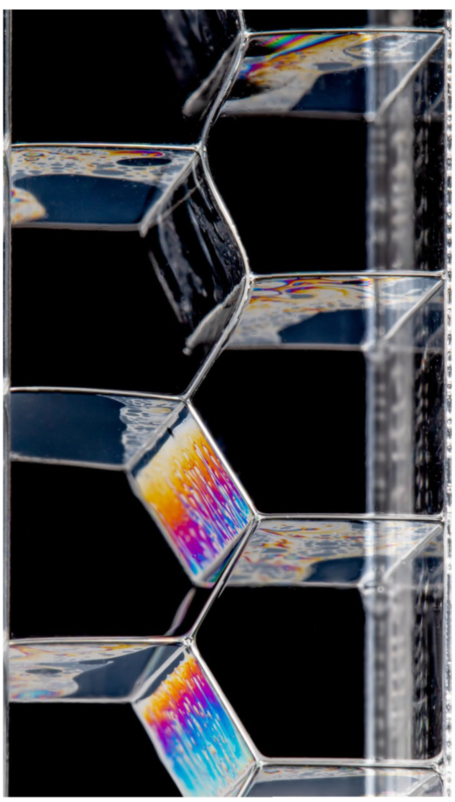
Editorial: First Annual APS DSOFT Gallery of Soft Matter

The inaugural Gallery of Soft Matter was held at the American Physical Society (APS) March Meeting 2022 in Chicago, organized by the APS Division of Soft Matter. The Gallery showcases the aesthetic appeal and elegance of soft matter systems, to be shared both with fellow researchers and the public. The submissions were judged for their combination of striking visual qualities and scientific interest. We received 32 poster and 34 video submissions from students and postdocs from all over the world. All entries are accessible at https://galleryofsoftmatter.wixsite.com/aps-dsoft. In this joint Editorial, each prize winner has summarized the science behind their entries. Together, they have provided impressive examples of the power of images in communicating the complexity and beauty of science.

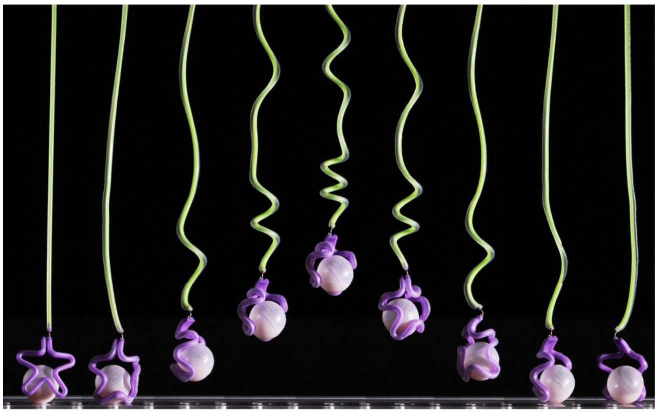
–Olga Shishkov, Emanuela Del Gado, and Irmgard Bischofberger



M. Jouanlanne, A. Egelé, D. Favier, W. Drenckhan, J. Farago, A. Hourlier-Fargette, Université de Strasbourg

Bending Plateau's Laws *(poster)* Beyond the beauty of their colors resulting from interference in thin liquid films, architectures of foams are easily recognizable, as they are strictly guided by capillarity, and more specifically by Plateau's laws. Confining soap bubbles in square section tubes leads to periodically ordered structures that follow these laws. The bubble column visible at the bottom of the image presents central soap films connected at angles of 120°. In the upper part of the image, the introduction of an elastic ribbon modifies these architectures—and bends Plateau's laws—as a result of a competition between elasticity and capillarity. The equilibrium structure of the confined foam-ribbon system depends on the thickness and thus the bending rigidity of the ribbons: Thin ribbons form wavy shapes with large amplitudes, while thick ribbons remain flat and impose a strong deformation of the initial structure. This system can be exploited to imprint a shape to a UV-curable composite ribbon.

–Manon Jouanlanne



T. J. Jones, M. Adler, E. Jambon-Puillet, J. Marthelot, P.-T. Brun, Princeton University

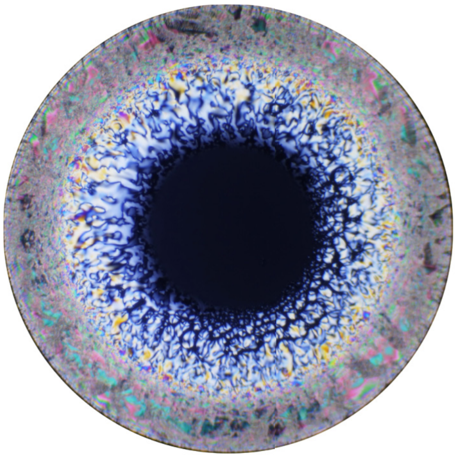
Fluid-Mediated Soft Actuators *(video)* Another elegant example of imparting shape to soft materials is a soft robot grasping and lifting a sphere, followed by gentle lowering and releasing of the sphere, as shown in the time sequence in the image. The soft robot is made of two independent soft actuators connected to a single pressure source. Each actuator is fabricated using a bubble casting process, where a liquid elastomer is deposited onto channel walls using an elongated air bubble, and the shape is set by the subsequent gravitational drainage and curing of the elastomer. When inflated, the actuator bends locally in response to the differential growth of the asymmetric membrane. Leveraging the fluid mechanics and a center-line model that treats the actuators as rods with tunable curvature, the composite actuator is programmed to sequentially grasp and then lift the sphere. As the soft robot is inflated, the gripper thus bends first at lower pressures. Only as inflation continues does the muscle-like actuator contract by coiling.

–Trevor J. Jones

A. Blonder, S. Shoval, O. Dar, E. Sharon, The Hebrew University HUJI

Frustrated Ceramics *(poster)* Novel processes to impart structure may further enable sustainable routes to create complex geometries. Architecture has begun to no longer see matter as inert but rather as a generative source for the development of form and structure. The theory of incompatible sheets describes the emergence of form and motion in matter. Geometrical incompatibilities are prescribed in the material, creating a flat “frustrated material” that spontaneously configures itself into a predictable, complex, three-dimensional shape. We developed “frustrated ceramics,” a route to create robust materials suitable for architecture. Going against ceramics best practice, which avoids internal stresses in the material entering the kiln, here incompatibilities are intentionally introduced by the joining of clays with different shrinkage rates, resulting in a complex-curved fired clay surface. The expected curvature in the material can be tuned by grooving of either surface, affecting curvature orientation when applied to the high-shrinking porcelain layer and affecting curvature amount when applied to the lower shrinking stoneware layer.

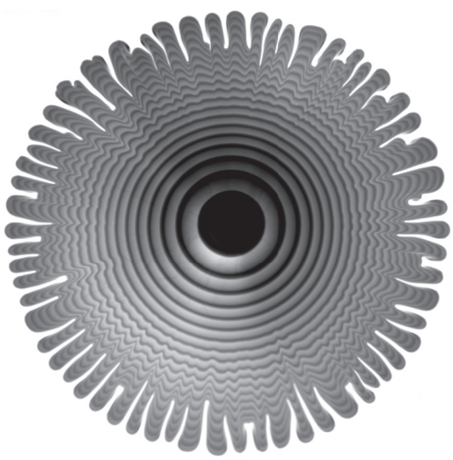
–Arielle Blonder



Q. Zhang, C. Peng, I. Bischofberger, MIT

Keeping an Eye on Drying Liquid Crystals *(poster)* Drops of isotropic lyotropic chromonic liquid crystals are an example of a system where complex structures spontaneously appear. As a drop of an aqueous disodium cromoglycate solution dries on an untreated surface, the suspended liquid-crystal aggregates are transported to the drop perimeter by an evaporation-driven capillary flow. The evaporation dynamics induces a nonuniform liquid-crystal concentration along the drop radius. The concentration governs the liquid-crystalline phase, and the concentration gradients induced by drying lead to eyelike multiphase drops: From the drop edge to the center a columnar phase, a nematic phase, and an isotropic phase are observed simultaneously. Are we watching the drop or is it watching us?

–Qing Zhang



S. Gowen, T. Videbæk, S. R. Nagel, University of Chicago

Behind the Interface *(video)* As any horror-film buff knows, when focused under an eerie ray of light, sweet, familiar objects acquire a sinister glow; visualization influences our perception. Take, for example, the viscous-fingering instability: Iconic reaching-finger patterns emerge as a less-viscous fluid propagates into a more-viscous one within a confined geometry. We observe these familiar fingers in a new light by injecting rings of alternately dyed fluid into a transparent higher-viscosity miscible fluid within the gap between flat glass plates. We discover perturbations of the dyed rings persisting far behind the undulating interface. They reveal a new length scale over which interfacial structure influences pressure gradients in the approaching fluid. It appears not at the well-studied instability onset but rather in the often dismissed, late-time finger-growth regime. While mesmerizing, these images should not be disparaged as merely cold fact. They possess, under the right illumination, a ghostly essence—the shadow of discovery.

–Savannah Gowen

Olga Shishkov
BioFrontiers Institute, University of Colorado Boulder, Boulder, Colorado, USA

Arielle Blonder
Racah Institute of Physics, The Hebrew University HUJI, Jerusalem, Israel

Savannah Gowen
Department of Physics and the James Franck and Enrico Fermi Institutes, University of Chicago, Chicago, Illinois, USA

Trevor J. Jones
Department of Chemical and Biological Engineering, Princeton University, Princeton, New Jersey, USA

Manon Jouanlanne
Université de Strasbourg, CNRS, Institut Charles Sadron UPR22, Strasbourg, France

Qing Zhang
Department of Mechanical Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts, USA

Emanuela Del Gado
Department of Physics and Institute for Soft Matter Synthesis and Metrology, Georgetown University, Washington, DC, USA

Irmgard Bischofberger
Department of Mechanical Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts, USA

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