Pneumatic Gaussian cells

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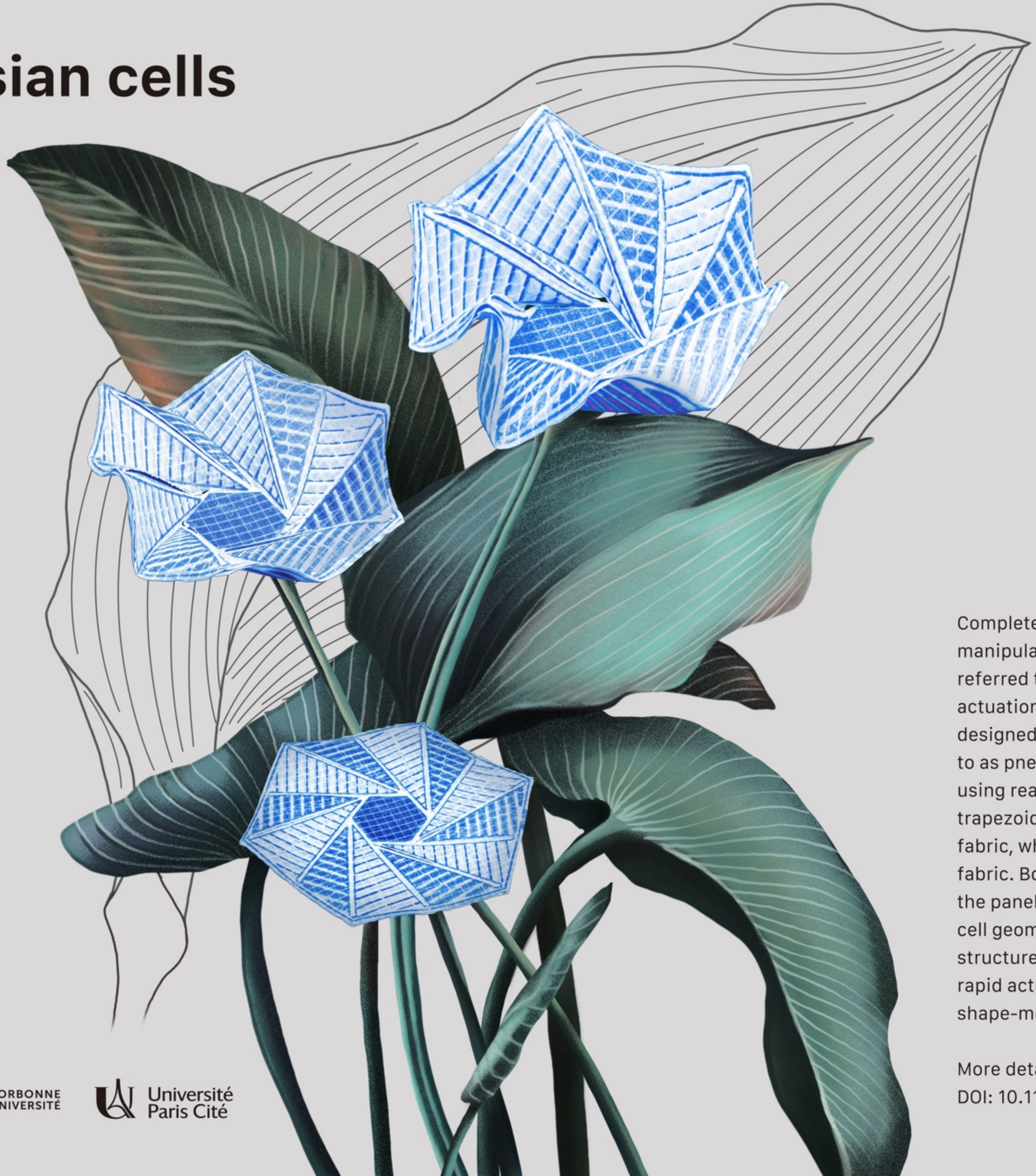

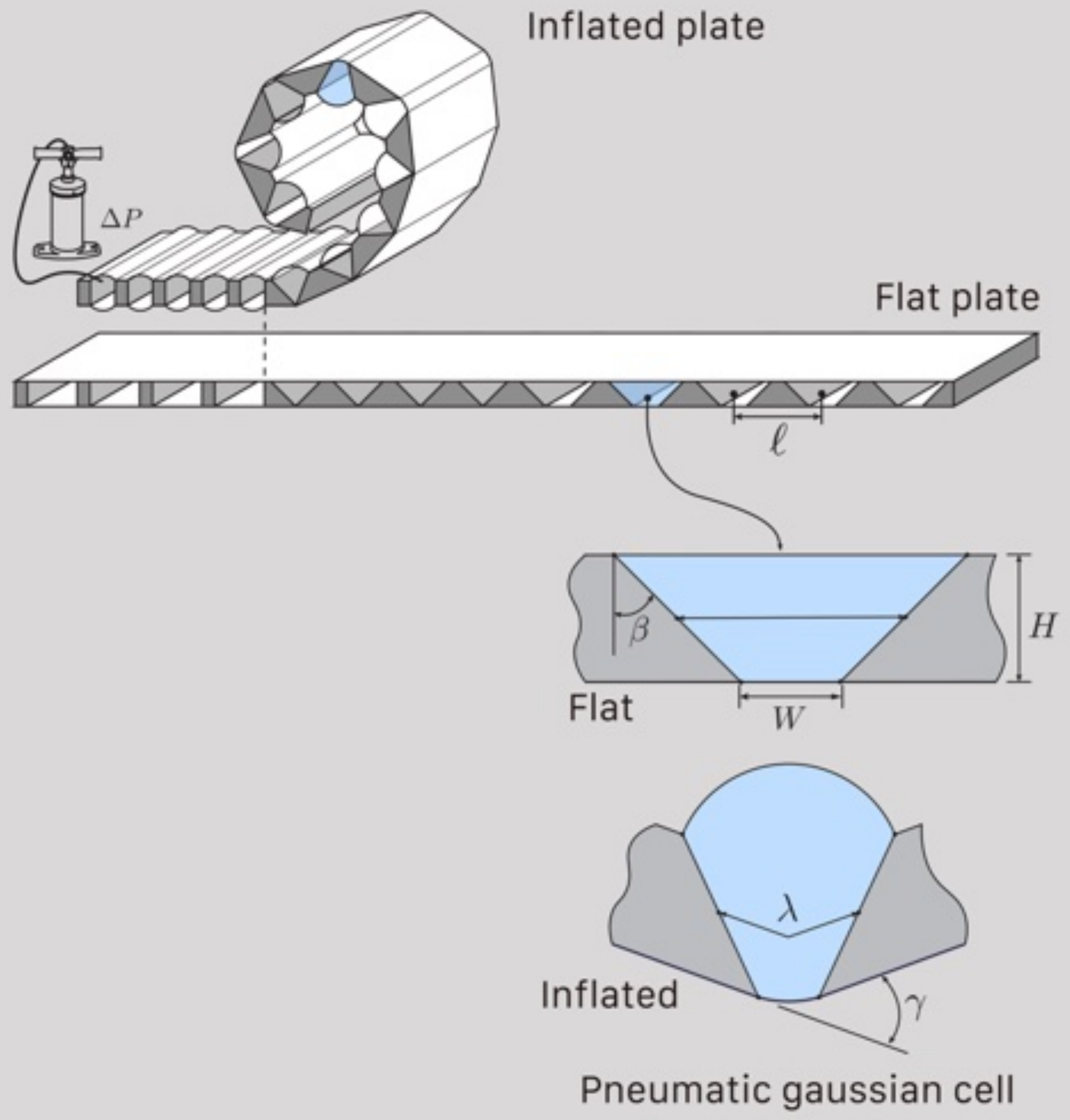

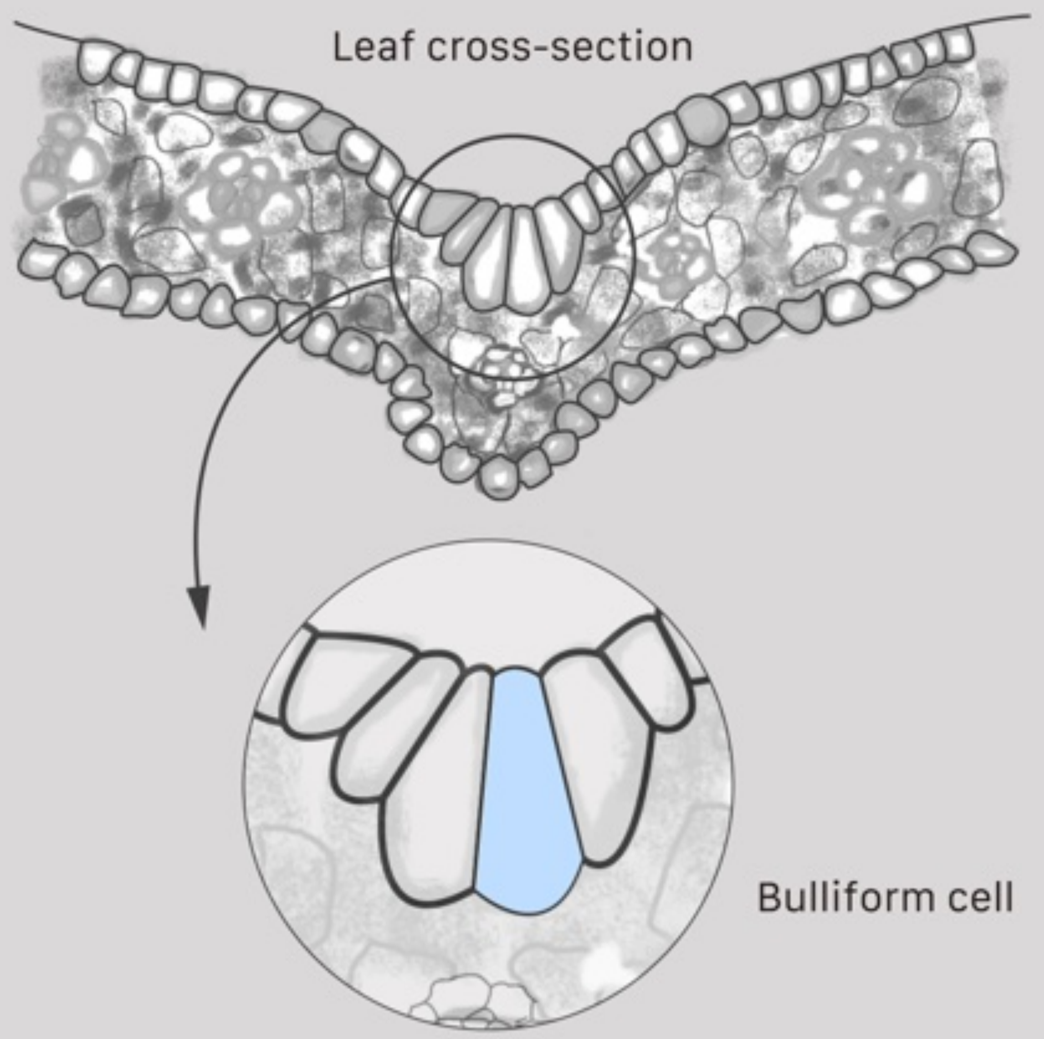

Complete morphing of a surface requires the simultaneous manipulation of metric distortion and bending curvature, referred to here as Gaussian morphing. Inspired by pneumatic actuation in monocotyledon plant leaves (bulliform cells), we designed thin panels embedded with inflatable units referred to as pneumatic Gaussian cells. These cells are constructed using readily available consumer-grade materials: creating trapezoidal channels through 3D printing on a layer of airtight fabric, which is then heat-sealed using a layer of the same fabric. Both in-plane contraction λ and angular deflection γ of the panels can be programmed simultaneously through the cell geometry (W/H, β), leading to targeted, three-dimensional structures. These structures exhibit controlled stiffness and rapid actuation, providing a route to large-scale shape-morphing robotics applications.

More details in Tian Gao et al, Science 2023,
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