Supplementary Data

Methods

Fabrication of Micropallet Arrays. Glass slides were cleaned by immersing them in freshly prepared piranha solution (3:1 concentrated H_2SO_4/30% H_2O_2 by volume) for 30 min. *Caution: piranha solution is highly corrosive. Extreme care should be taken when handling it.* The slides were then rinsed with deionized water and dried in a nitrogen stream. The slides were dehydrated on a 200°C hotplate for at least 5 min before use. SU-8 films of 55 μm thickness were obtained by spin coating the SU-8 resist (formulation 50) on the glass slides at 500 rpm for 10 s, followed by 2000 rpm for 30 s using a spin coater (Model WS-200-4NPP, Laurell Technologies Corp.). The coated slides were baked on a hotplate at 65°C for 6 min, followed by a second bake at 95 °C for 20 min to remove organic solvent. After baking, the slides were slowly cooled to room temperature. To prepare an SU-8 micropallet array, the SU-8 film was exposed to UV light through a photomask with the designed features for 50 s using an Oriel collimated UV source (6.5 mW/cm^2). The postexposure baking was performed on a hotplate at 65°C for 1 min and 95°C for 5 min. After slowly cooling to room temperature, the SU-8 samples were developed in SU-8 developer for 6 min, rinsed with 2-propanol, and dried in a stream of nitrogen. Fabrication of SU-8 micropallet arrays of alternative thicknesses (15, 28, 55, 84 μm) was performed using the same process, except that the appropriate time parameters for that thickness were substituted.[27]

Silanization of Micropallet Arrays. After fabrication of SU-8 pallets on a glass substrate, the pallet array was baked for 2 h on a hotplate at 95°C to remove any residual solvent. The formation of a hydrophobic perfluoroalkylsilane layer on the silicone oxide

surface was carried out in a low-pressure reactor as described previously.[3] Briefly the array and a small plastic Petri-dish containing 100 μL of (heptadecafluoro-1,1,2,2-tetrahydrodecyl)trichlorosilane or octadecyltrichlorosilane (OTS) were placed inside a 100-mm-internal-diameter Wheaton dry-seal desiccator. The desiccator was then attached to an oil-free diaphragm vacuum pump (Vacubrand, Fisher Scientific) for 1 min (7 torr). The desiccator was detached from the pump and then maintained under vacuum for 16 h at room temperature. Afterwards, the array was placed under a high vacuum (2×10^{-3} torr) using a standard oil vacuum pump (Fisherbrand, Fisher Scientific) for 2 h to remove any unreacted silane molecules. The array was stored in a vacuum desiccator until use.

Results and Discussion

Octadecyltrichlorosilane (OTS) was also tested to establish Cassie-Baxter wetting (Figure S1B). OTS is covalently linked to hydroxyls on the glass surface via an Si-O bonds. After reaction of a glass surface with OTS, the contact angle of a water droplet on the surface increased to 100°. When a film of SU-8 was incubated with OTS, the contact angle of a water droplet increased to 95°. Thus it was likely that the OTS also coated the SU-8 surfaces of the micropallets. The increase in the contact angle of both glass and SU-8 surfaces following coating with OTS suggests that all of the array surfaces underwent an increase in hydrophobicity. However, when the OTS-coated pallet array was submerged in water and immediately viewed, Wenzel wetting was present similar to that of arrays without an OTS coating. This result demonstrates that the OTS-coated arrays were not sufficiently hydrophobic to establish Cassie-Baxter wetting.

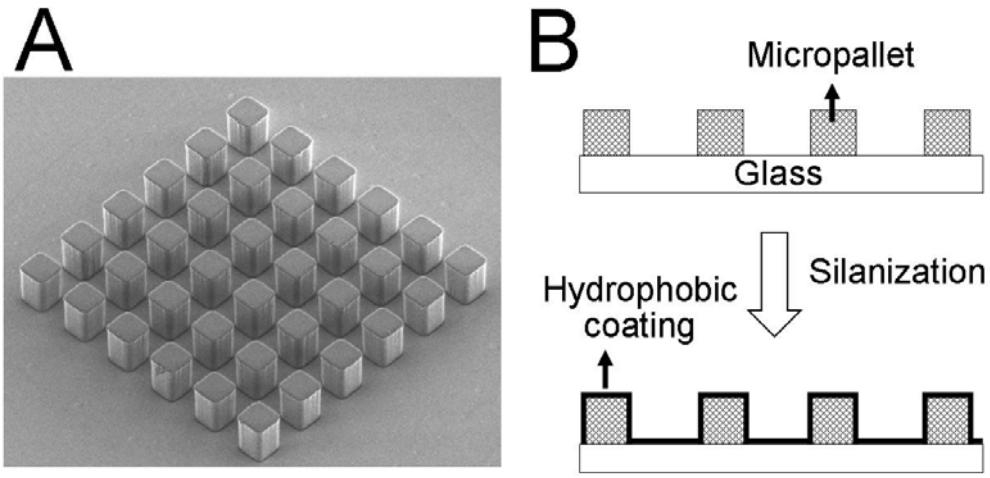

Figure S1. Dependence of wetting on the surface hydrophobicity of micropallet arrays. (A) SEM image of a 6 × 6 pallet array (55 μm height, 50 μm length, 50 μm inter-pallet gap). (B) Schematic of the silanization of a pallet array with a hydrophobic silane.

Influence of the pH of the Wetting Liquid on Virtual Wall Stability. Biological solutions are typically neutral in pH. However, many biologic solutions must be either acidic or basic to maintain the solubility of a reagent. For example, collagen used as a substrate for cell adhesion, must be applied to surfaces in a solution with a pH less than 4.5 to maintain solubility. Thus it is important to understand how acidic or basic solutions will impact array wetting. Sodium phosphate (0.1 M) with varying pH was applied to an array of pallets. The arrays were then examined over time for their wetting properties (Fig. S2). After 24 h, Cassie-Baxter wetting was present on all arrays irrespective of the pH. By 72 hours, arrays immersed in solutions with a pH of $\geq$11 displayed a mixture of Cassie-Baxter and Wenzel wetting. Following 192 hours of immersion, arrays in solutions of pH 10 also displayed unstable wetting properties. Thus

Cassie-Baxter wetting was stable for long times in solutions with a pH less than 10. The lack of long term stability of Cassie-Baxter wetting at alkaline pH was most likely due to the hydrolysis of the Si-O bond covalently linking the perfluoroalkylsilane to the SU-8 and consequent decrease in hydrophobicity of the SU-8 surface.

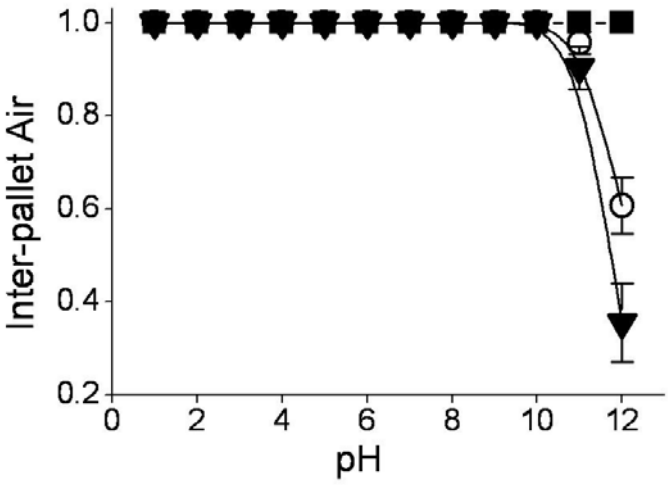

Figure S2. Influence of pH on the long-term stability of Cassie-Baxter wetting on a 55 × 50 × 50 μm (h × b × a) pallet array. Pallet arrays were immersed in sodium phosphate (0.1 M) at varying pH and then viewed by microscopy after 24 (solid squares), 72 (open circles), and 192 (solid triangles) hours. The fraction of the inter-pallet area covered in air was plotted against the pH of the solution.