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A noble microfluidic device for protein crystallizations. JUNG-UK SHIM, SETH FRADEN, Brandeis University — A high throughput, low volume microfluidic device has been constructed out of poly(dimethylsiloxane) elastomer. We have demonstrated that sub-nanoliter water-in-oil drops of protein solutions of different composition can be rapidly stored in individual wells, which allows screening of 1000 conditions while consuming a total of only 1 microgram protein on a 20 cm^2 chip. This reduction in protein needed for crystal screens allows high-throughput crystallization of mammalian proteins expressed in tissue culture. A significant advance over current microfluidic devices is that each pot is in contact with a reservoir through a dialysis membrane which only water and other low molecular weight organic solvents can pass, but not salt, polymer or amphiphile. This enables the concentration of all solutes in a solution to be reversibly, rapidly, and precisely varied in contrast to current microfluidic methods, which are irreversible. This microfluidic dialysis technology solves a major problem in protein crystallization, the decoupling of nucleation from growth. The device will also be useful for general studies of the phase behavior of protein solutions.

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