

W0041

The Phase Chip: High Throughput Screening with Microfluidics. Jung uk Shim, Seth Fraden, Physics Dept., Brandeis Univ., Waltham, MA 02454 USA.

A high throughput, low volume microfluidic device denoted the Phase Chip 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 μg 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 sample well is in contact with a reservoir through a dialysis membrane through 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 Phase Chip will also be useful for general studies of the phase behavior of protein solutions, including diseases associated with protein aggregation and phase separation such as cataracts, gall stone formation, and Alzheimer's Disease.