

Miniaturization of chemical and biochemical experimentation: smaller, faster, cheaper, and better?

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Tremendous interest in microfabricated fluidic channel structures (microchips) has grown over the past decade due to the large number of powerful demonstrations that have appeared in the literature. The diversity of chemical and biochemical measurement techniques implemented on microchips is large including various electrophoretic and chromatographic separations, chemical and enzymatic reactions, noncovalent recognition interactions, sample concentration enhancement, and cellular manipulations. In addition the types of samples addressed by microchips has been broad in scope, e.g., small ions and molecules, single and double stranded DNA, amino acids, peptides, and proteins. These devices have low cost devices and small footprints while consuming miniscule quantities of reagents and producing rapid results. Moreover, the manufacturing strategy used to make these devices, i.e., photolithography, allows highly parallel systems to be fabricated at low incremental cost. All of these features suggest the possibility to perform chemical experimentation at a massive scale at low cost on a bench top. Examples will be presented showing various biochemical experiments that have been successfully transferred to these miniature platforms. Prospects for the future will also be discussed.