Forward

Microfluidics is the engineering discipline that deals with devices and phenomena related to minute amounts of fluids – typically with dimensions on the order of less than a millimeter and volumes of less than a milliliter. Nature, as always, did it first: surface tension coalesces water into rain droplets and capillary forces pump fluids through small plant vessels since the dawn of time. Manipulating such small quantities is not easy, and engineers have learned to build very small containers, valves and pumps to handle fluids at a sub-millimeter scale. The problem is, once the liquids are inside the channels, they are not very accessible. For example, Beebe et al. (Science, 2001) demonstrated that liquid flows inside microchannels could be confined by two physical walls (instead of four, as usual) – leaving "air walls" on the side for gas exchange. However, most biochemical reactions occur in the fluid phase. Starting in 2005, surely inspired by the plethora of legendary, Nobel Prize-winning scanning probes developed by IBM Research (such as the Scanning Tunneling Microscope and the Atomic Force Microscope), the authors at IBM Zürich developed a clever scanning microfluidic probe that allowed for exchanges of fluids on "open" (i.e. pipette-accessible) surfaces and continue to create a range of such probes for use with biological substrates. The editors of this book are thus ideally placed on a privileged vantage point to compile work on open-space microfluidics and have been inclusive of numerous scanning liquid localization methods.

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