



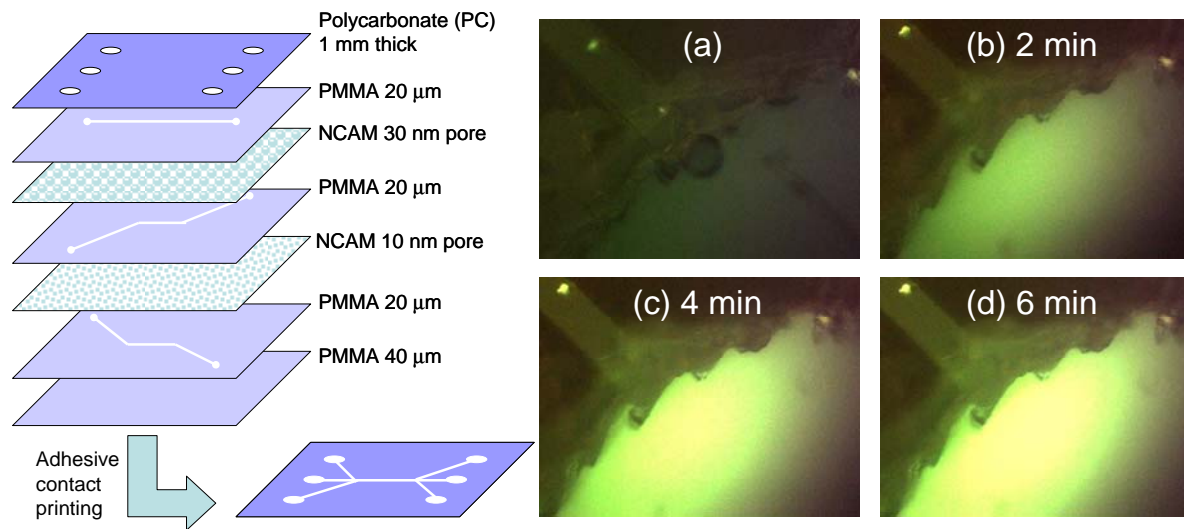
# Ultrafiltration of Biological Samples for Fraction Through Multiple Nanocapillary Array Membranes Alternately Sandwiched Between Microfluidic Channels



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The combination of microfluidics and nanofluidics enables a range of molecular manipulations for mass/volume-limited applications, critical for nanomanufacturing systems and to create a sensitive analytical measurement platform. Molecular sizing and filtration of samples is one such capability. As the diameter of nanocapillaries are comparable to the sizes of larger molecules such as proteins and dextrans, we can selectively hinder or transport analytes to fractionate a mixture. The ability to perform online sample fractionation before performing reactions or analyses is important where serial processes are performed without additional offline handling. We designed and fabricated a device by using two nanocapillary array membranes (NCAMs) alternately sandwiched between three microfluidic channels as schematically demonstrated in Figure 7.9.

Proof of concept experiments demonstrate the ultrafiltration of dextrans and proteins. As shown in Figure 7.9, we can selectively concentrate fluorescently-labeled dextrans. We have also demonstrating protein-selective concentration using FITC-lectin (MW 53 K Da) and FITC-insulin (MW 5.8 K Da). This device is useful for performing appropriate chemical reactions within the devices, as well as allowing cellular constituents to be fractionated before they are chemically manipulated and characterized.



**Figure 7.9:** Left. Schematic diagram of the device design and structure. Right: Demonstration of fractionation. (a) No accumulation of MW 2000 K Da dextran-FITC was observed. (b), (c) and (d) show the accumulation of MW 40 K Da dextran-FITC. The NCAM pore diameter for the results shown here was 30 nm.