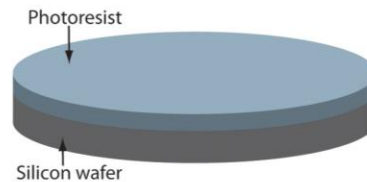
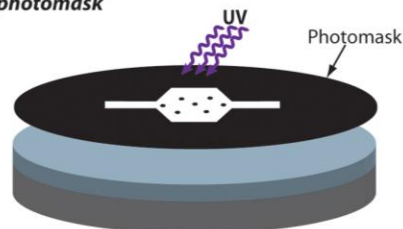


MASTER FABRICATION

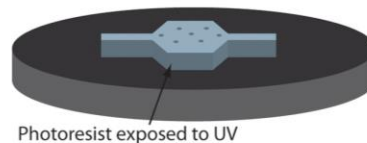
1. Spin-coat photoresist on a silicon wafer



2. Expose photoresist to UV light through a photomask

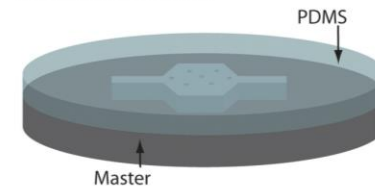


3. Develop exposed wafer with photoresist



PDMS REPLICATION MOLDING

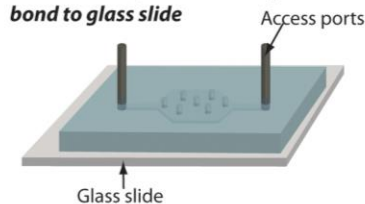
1. Pour PDMS monomer and cross-linker mixture onto master



2. Cure and peel-off PDMS



3. Cut devices, create access ports and bond to glass slide



MINIATURIZACE

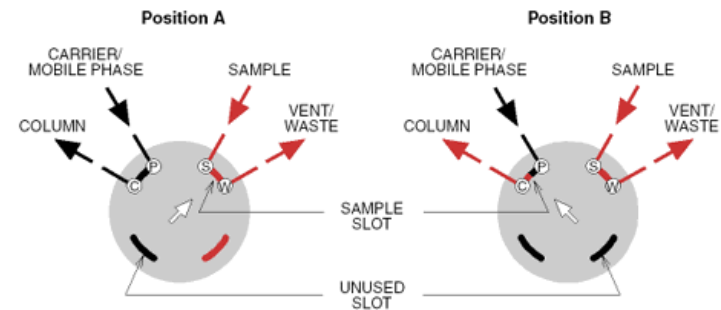
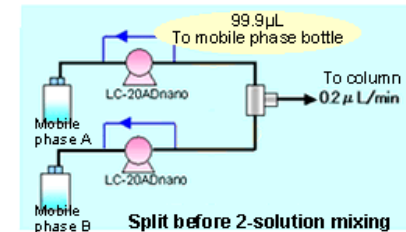
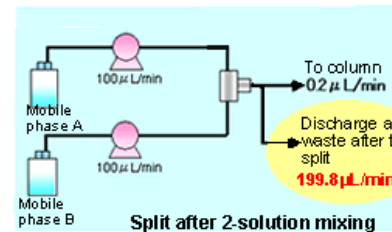
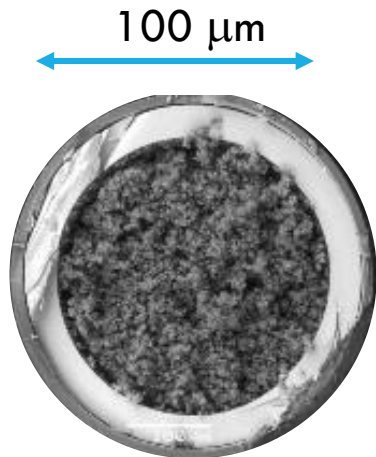
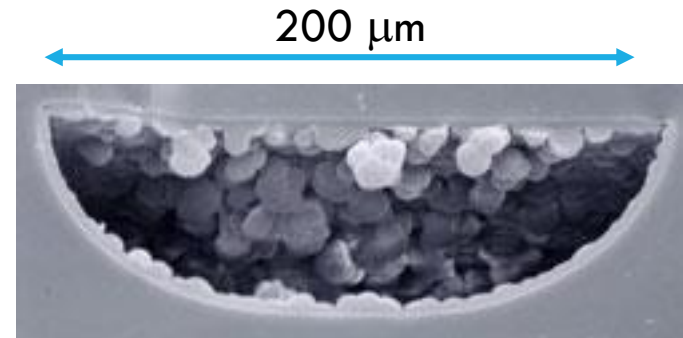
Pokročilá kapalinová chromatografie



MICROFLUIDNÍ TECHNOLOGIE

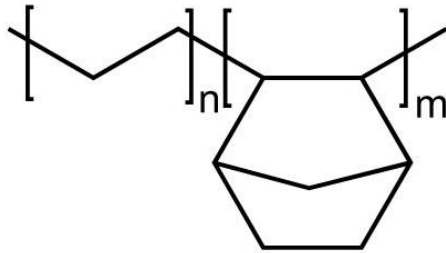
„Microfluidics deals with the behavior, precise control and manipulation of fluids that are geometrically constrained to a small, typically sub-millimeter, scale.“

wikipedia.org

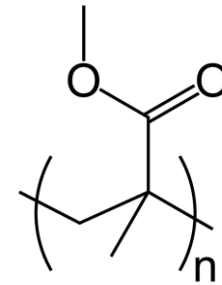


POLYMER

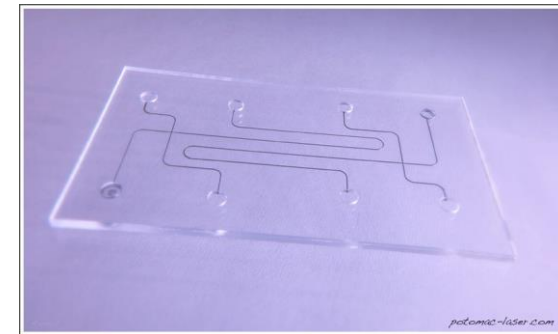
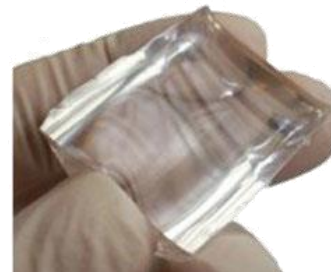
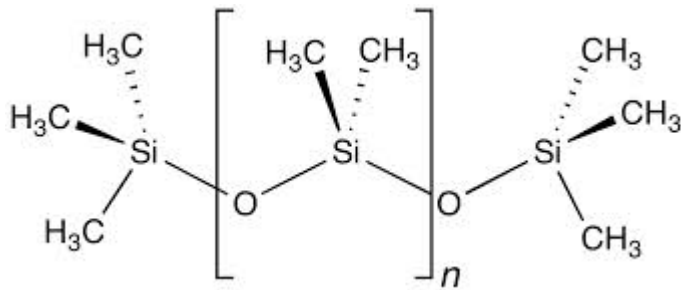
Kopolymer cylického olefinu (COC)



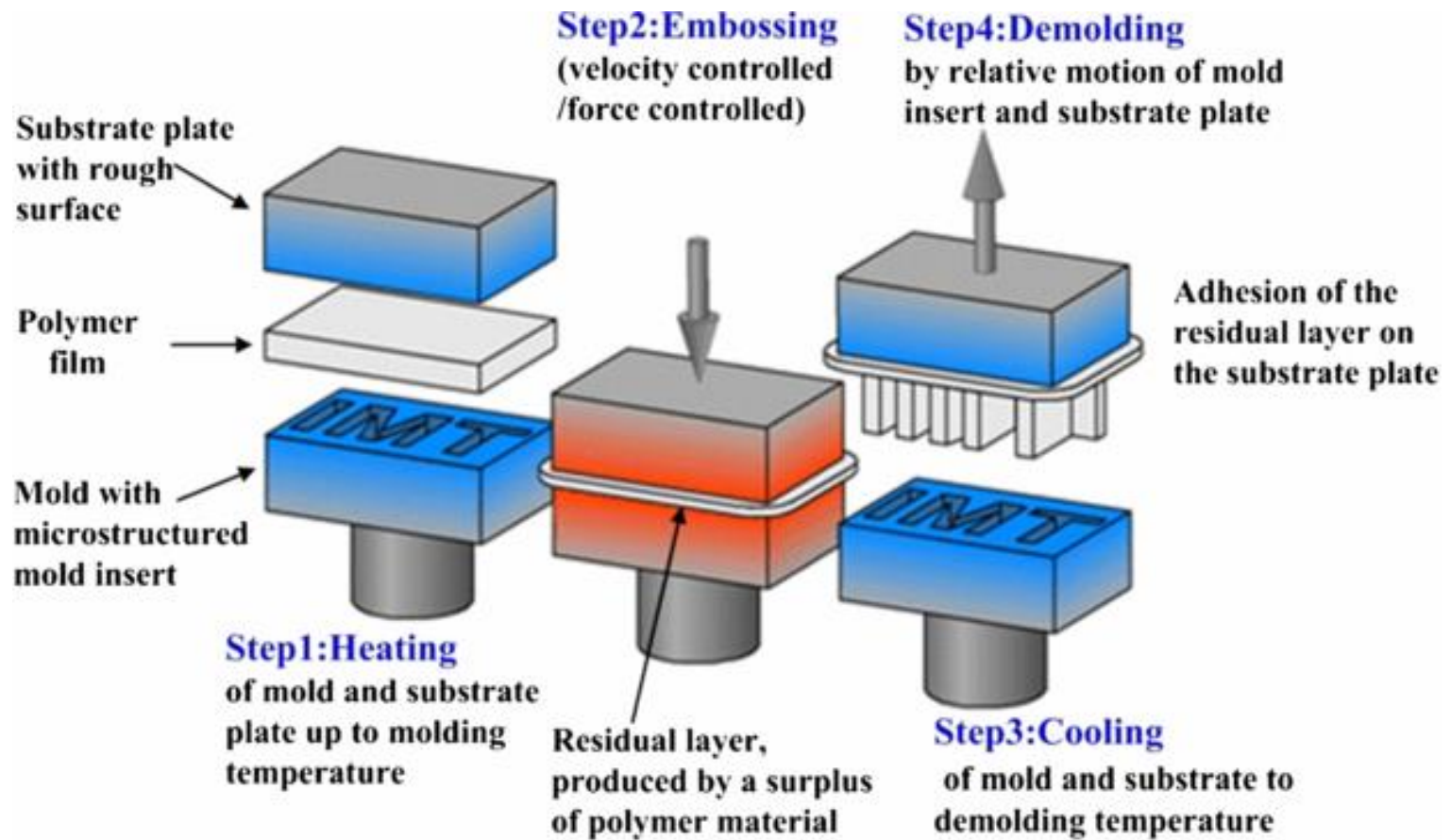
Polymetylmetakrylát (PMMA)



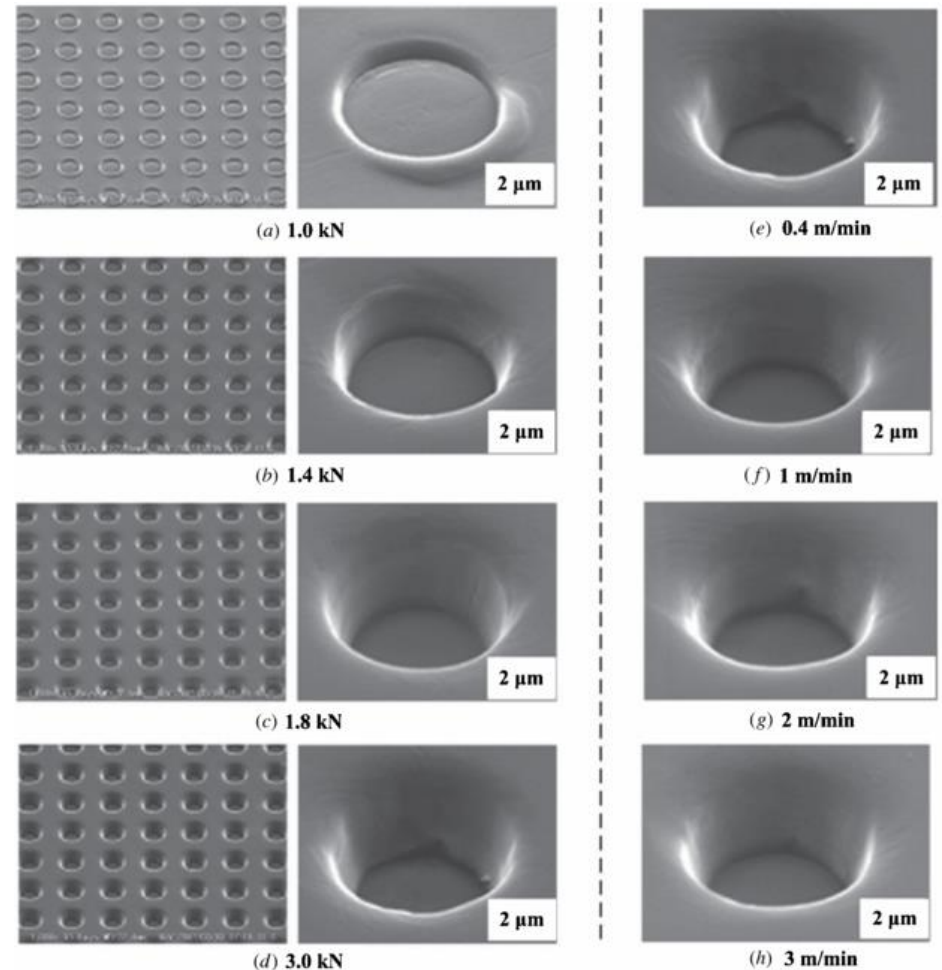
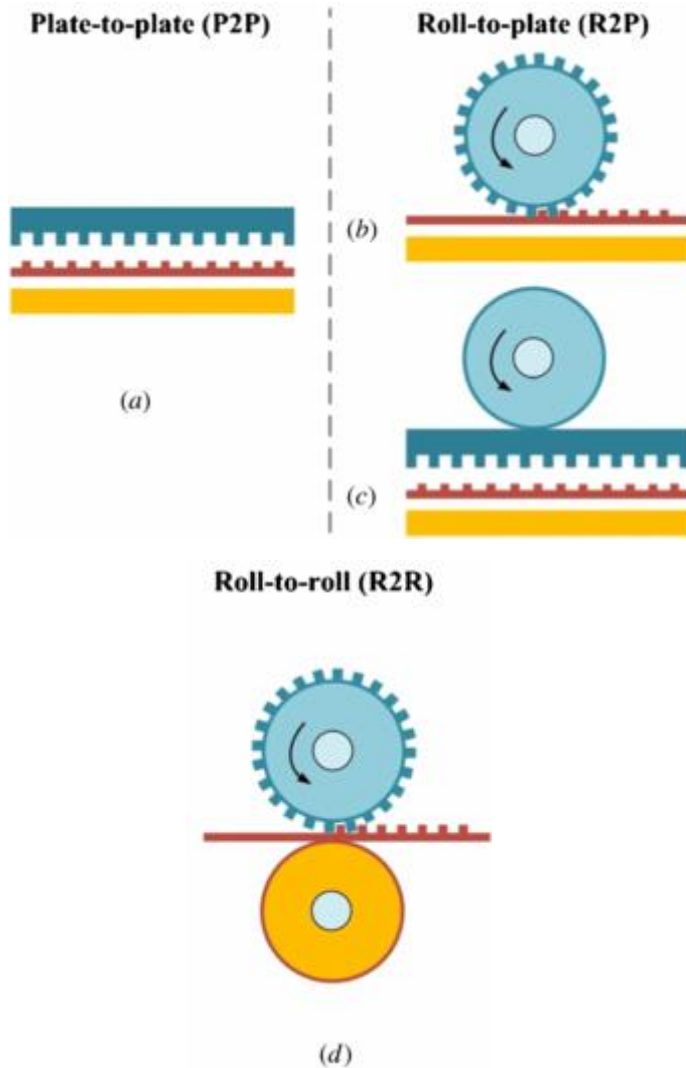
Polydimethylsiloxan (PDMS)



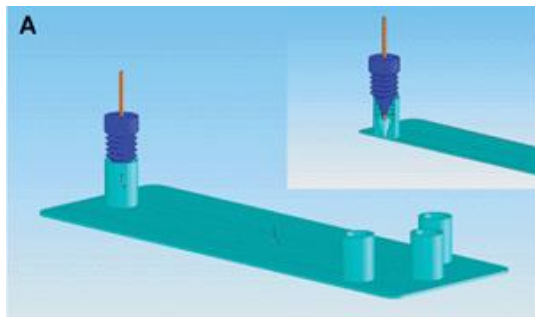
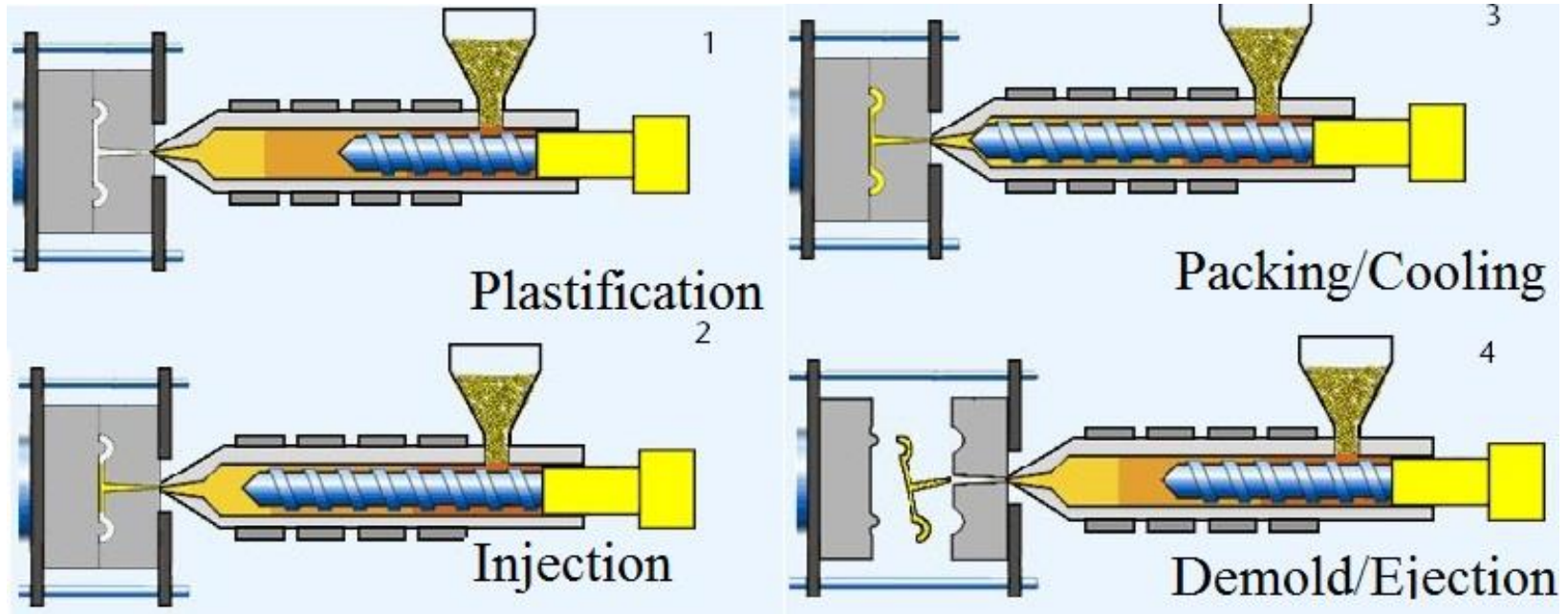
RAZÍTKOVÁNÍ (HOT EMBOSsing)



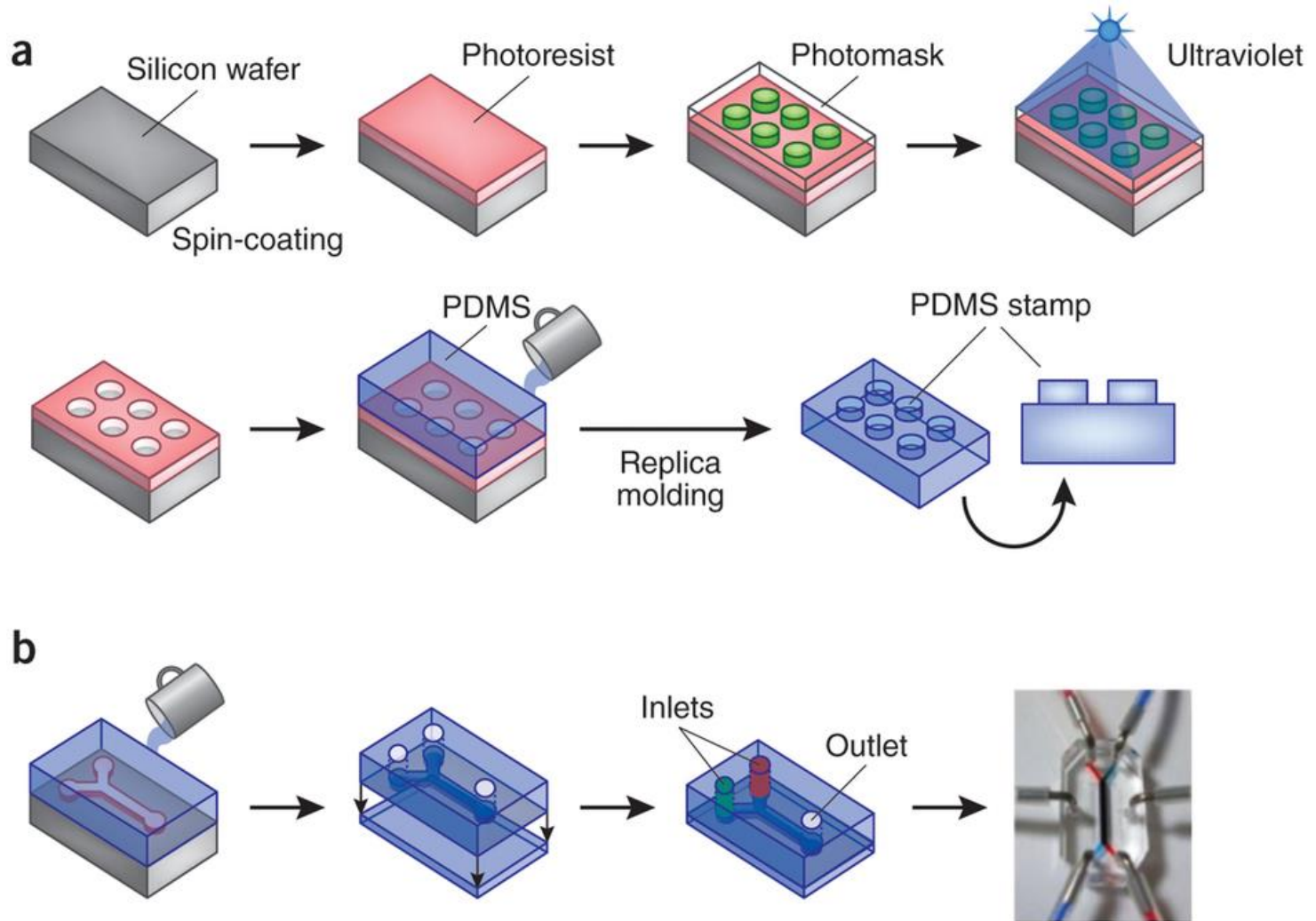
RAZÍTKOVÁNÍ (HOT EMBOSSING)



VSTŘIKOVÁNÍ (INJECTION MOLDING)

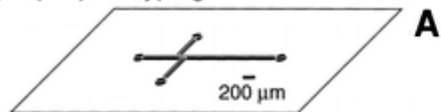


LITOGRAFIE

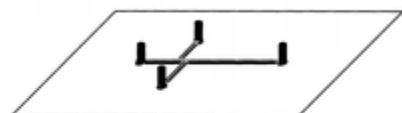


LITOGRAFIE – RAPID PROTOTYPING

A Fabricate master by rapid prototyping



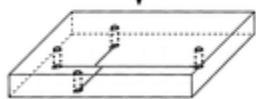
B Place posts to define reservoirs



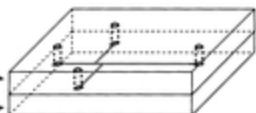
C Cast prepolymer and cure



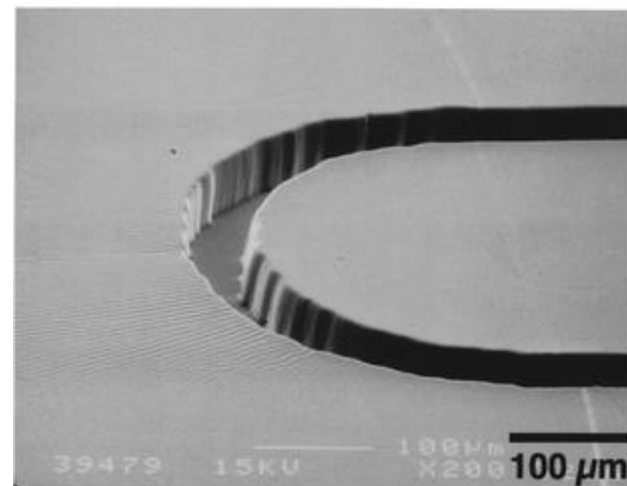
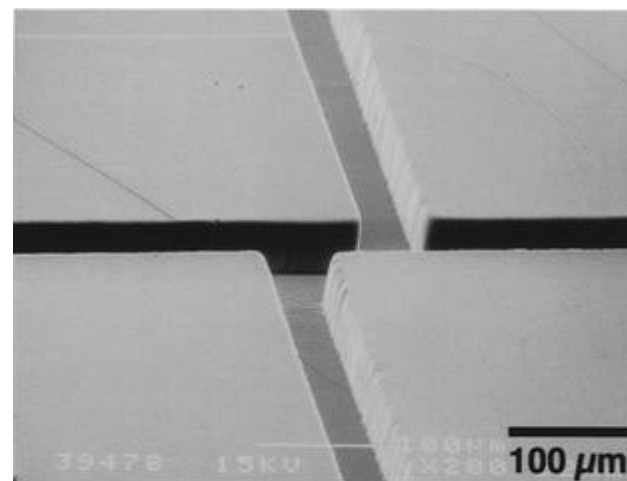
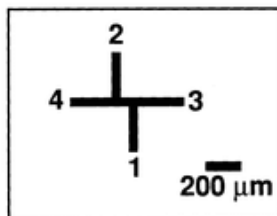
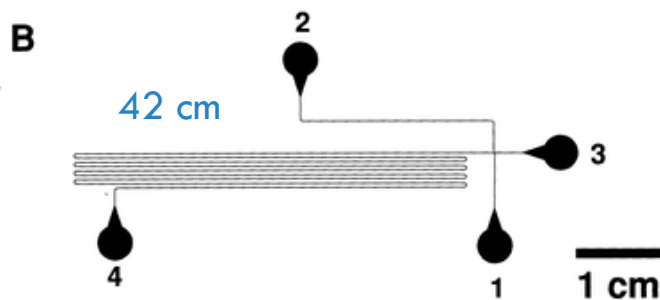
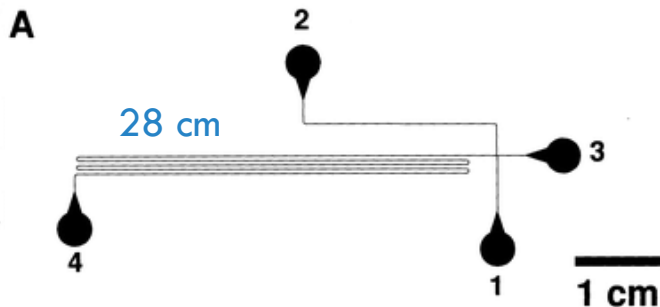
D Remove PDMS replica from master



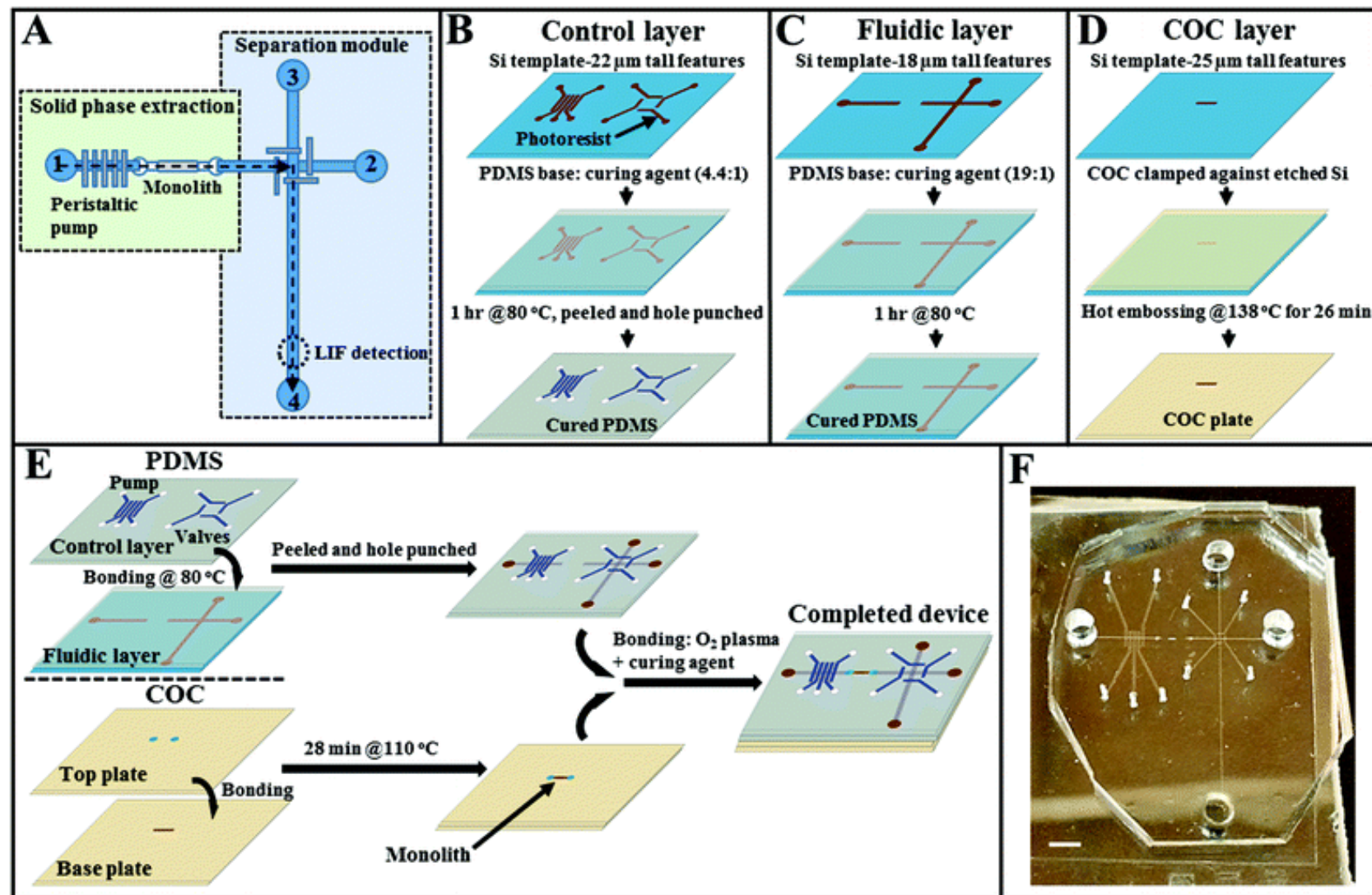
E Oxidize PDMS replica and flat in plasma and seal



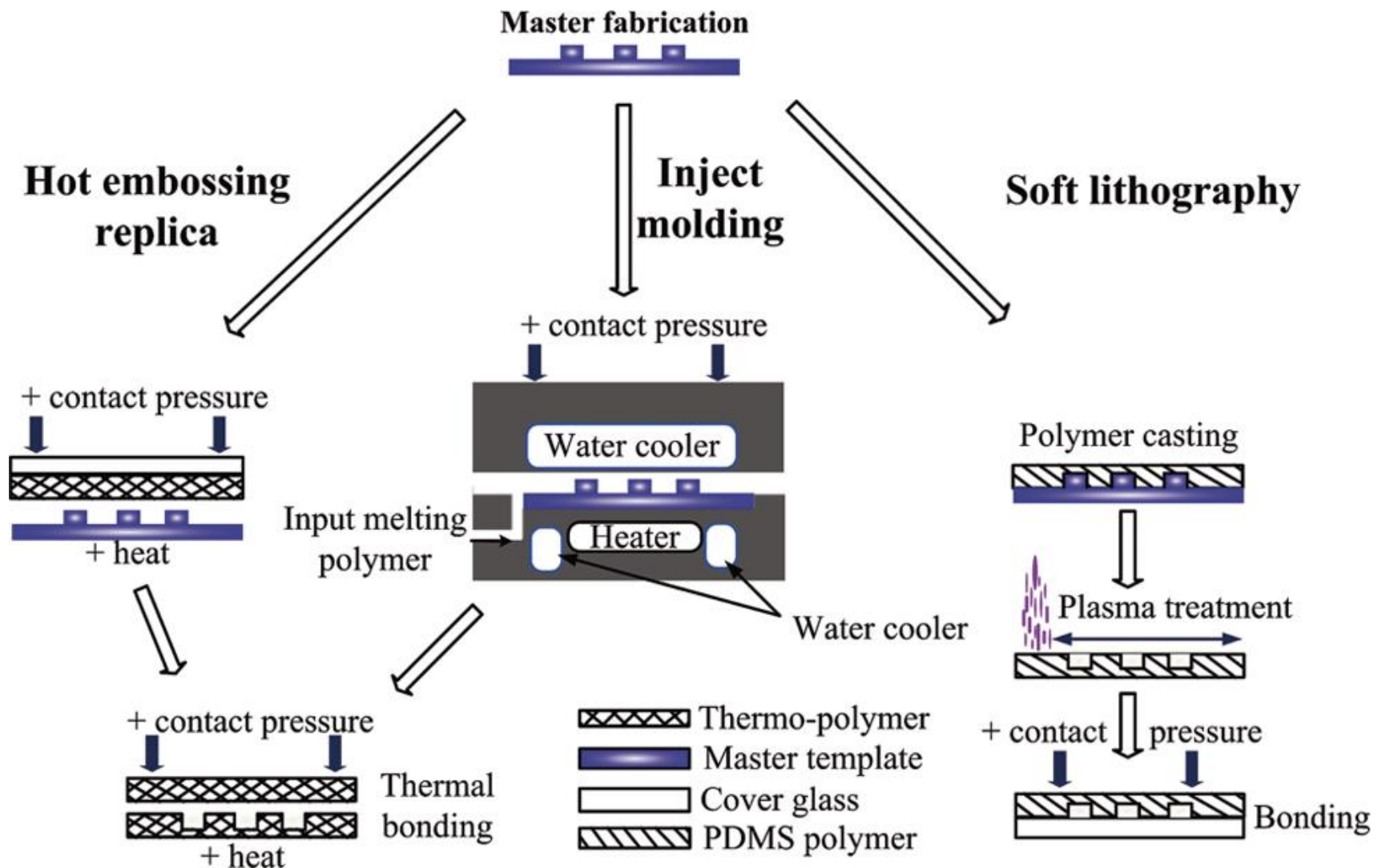
replica
flat



SPE-CE



SROVNÁNÍ TECHNIK



LEPTÁNÍ SKLA

Cross-Sectional View of Fabrication Steps

- Fisher Finest Microscope Slide (25 mm x 75 mm x 1.1 mm)
- Chromium (300 nm)
- Shipley 1813 Photoresist (2 μm)

The glass slides are pre-cleaned in a fresh piranha solution (3 H₂SO₄ : 1 H₂O₂) for 10 minutes.

A chromium layer is deposited on the glass with the Denton Discovery 18:

- Power - 150 W
- Argon flow rate - 12.5 sccm
- Sputter time - 6 min
- Deposition rate - 50 nm/min
- Pressure - 2.5 mT

The exposed chromium layer is removed by immersing the substrate in CR-14-S chromium etchant for 90 seconds.

The backside of the substrate is masked with a 1 mil polyimide tape (Kapton) with silicone adhesive. The substrate is then immersed in an etchant bath of 1 HF : 3 HNO₃ : 10 H₂O to etch the exposed glass at a rate of 1.5 μm/min.

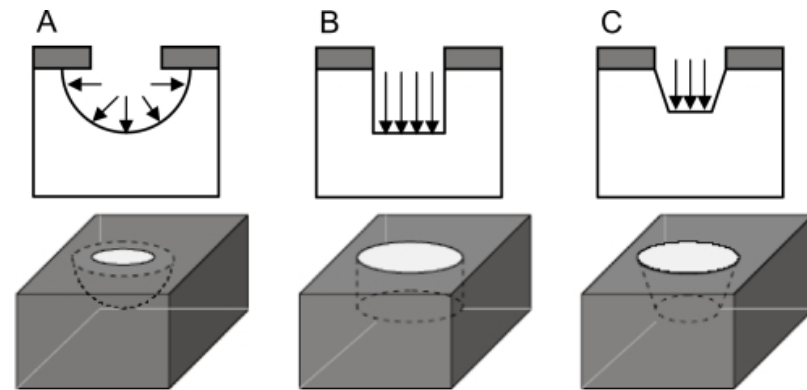
The channels are sealed by sandwiching the etched substrate and a blank glass slide between graphite paper, which is then sandwiched between 0.5 kg stainless steel blocks. This stack is heated to 600°C at a rate of 10°C/min, baked for 4 hours, and then allowed to cool. This fusion process creates a single glass substrate with embedded channels.

The photoresist is deposited and patterned:

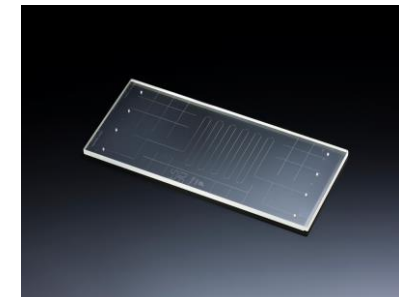
- Spin rate - 2000 rpm
- Spin time - 30 sec
- Soft bake - 90 sec @ 95°C
- UV - 8 sec exposure (EV 420 Mask Aligner)
- Developer - 60 sec (Shipley 352)
- Hard bake - 5 min @ 150°C

All photoresist is removed with acetone, and the substrate is immersed in the CR-14-S until all chromium is removed.

Access holes are made with a Dremel rotary tool (30,000 rpm), a Dremel tool press, and a diamond-tipped Dremel bit. Water is used as a cooling fluid. All pieces are then cleaned in a piranha bath.



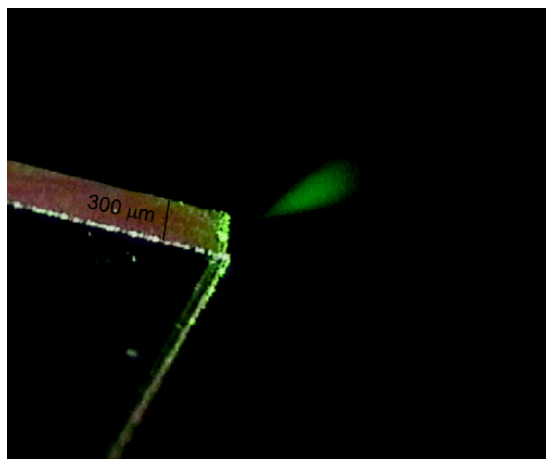
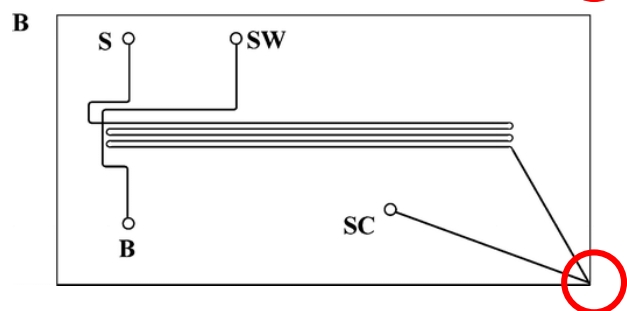
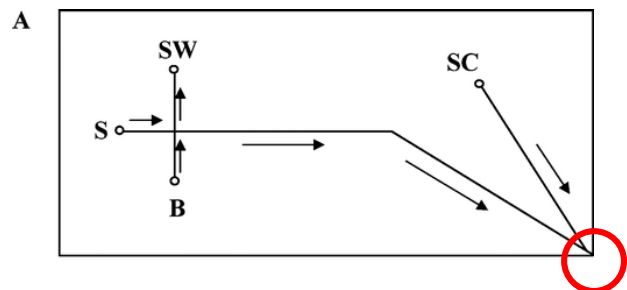
www.indiamart.com



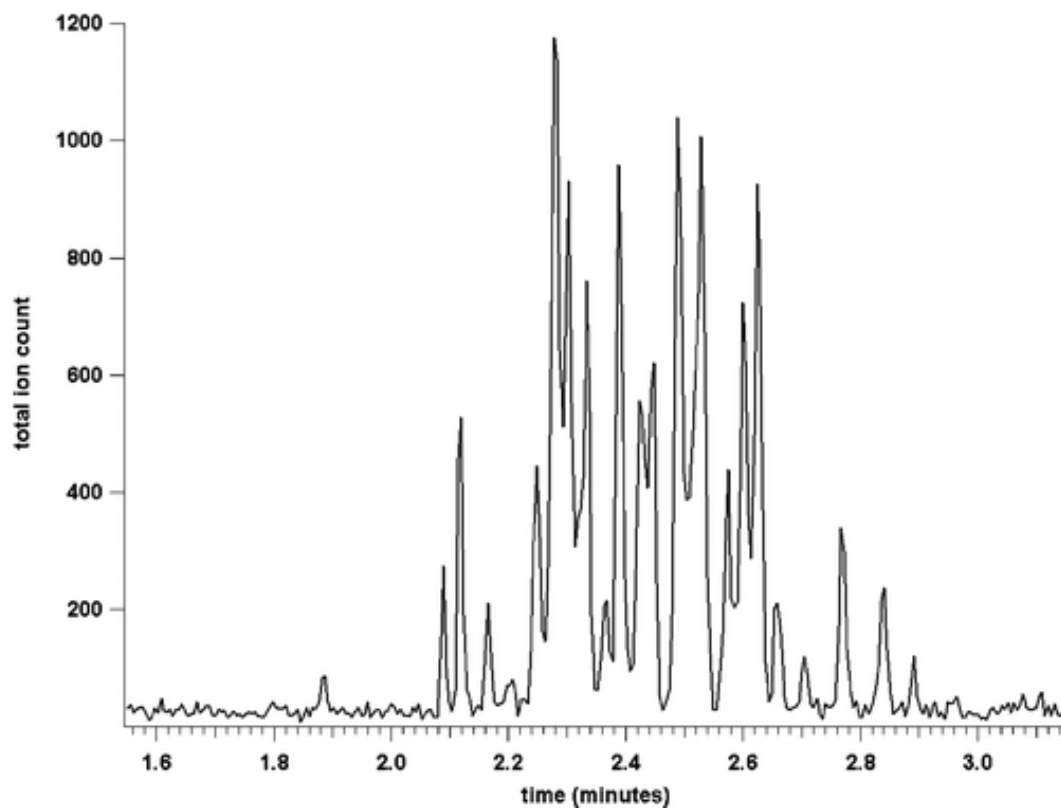
www.anff.org.au

ion.chem.usu.edu/~tapaskar/nanoutah07/P3.pdf

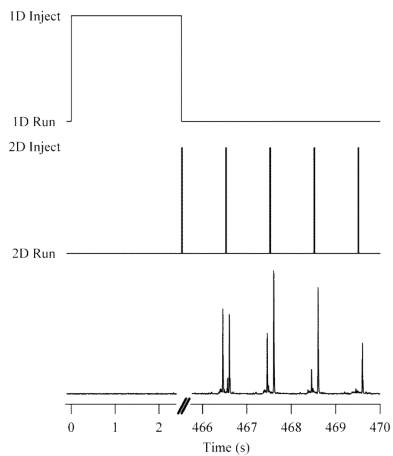
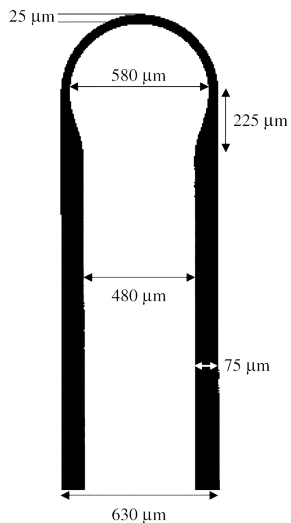
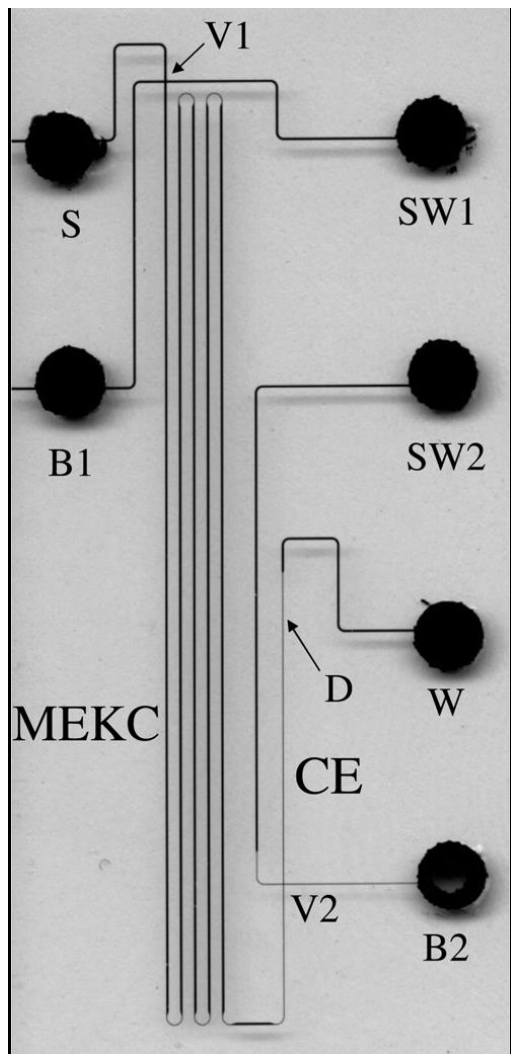
μ CE-ESI-MS



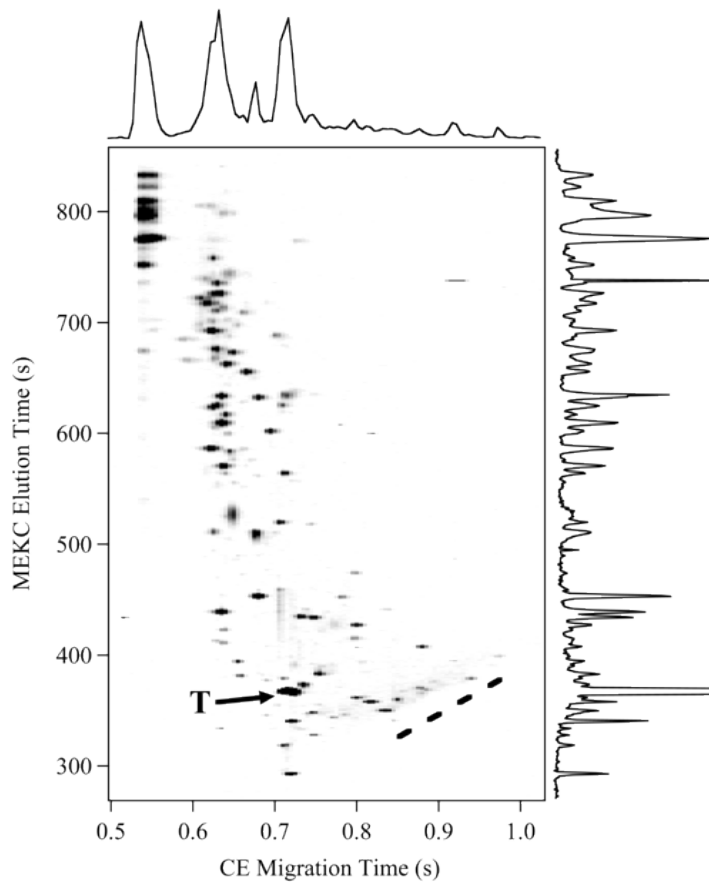
BSA tryptic digest



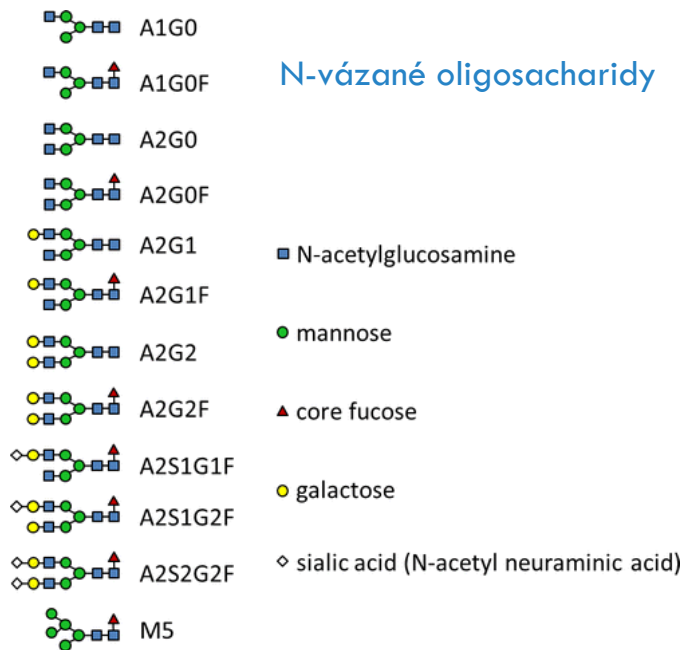
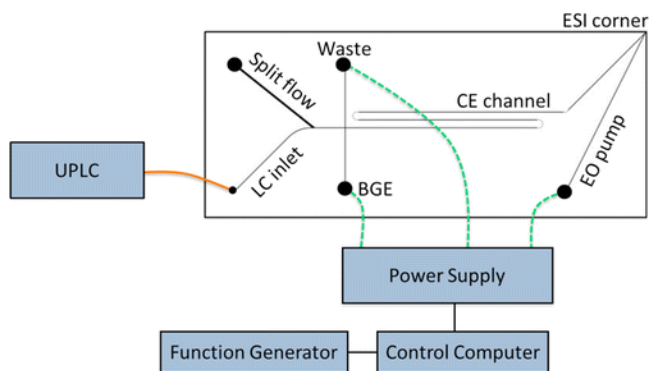
MEKC-CE



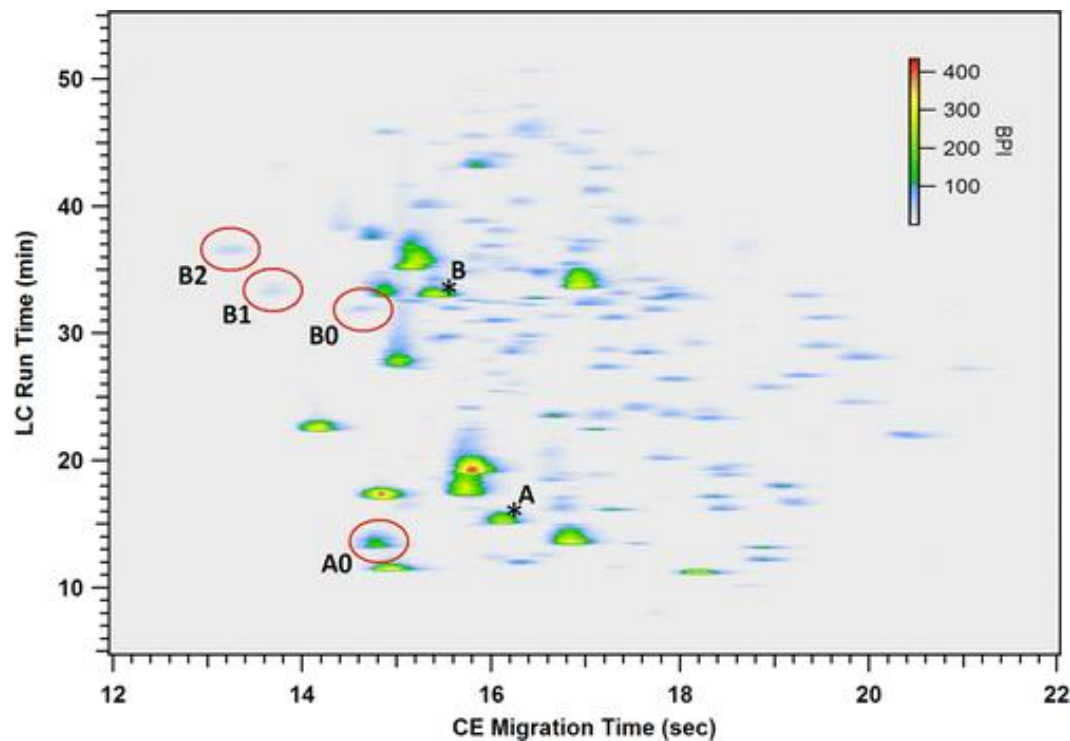
BSA tryptic digest



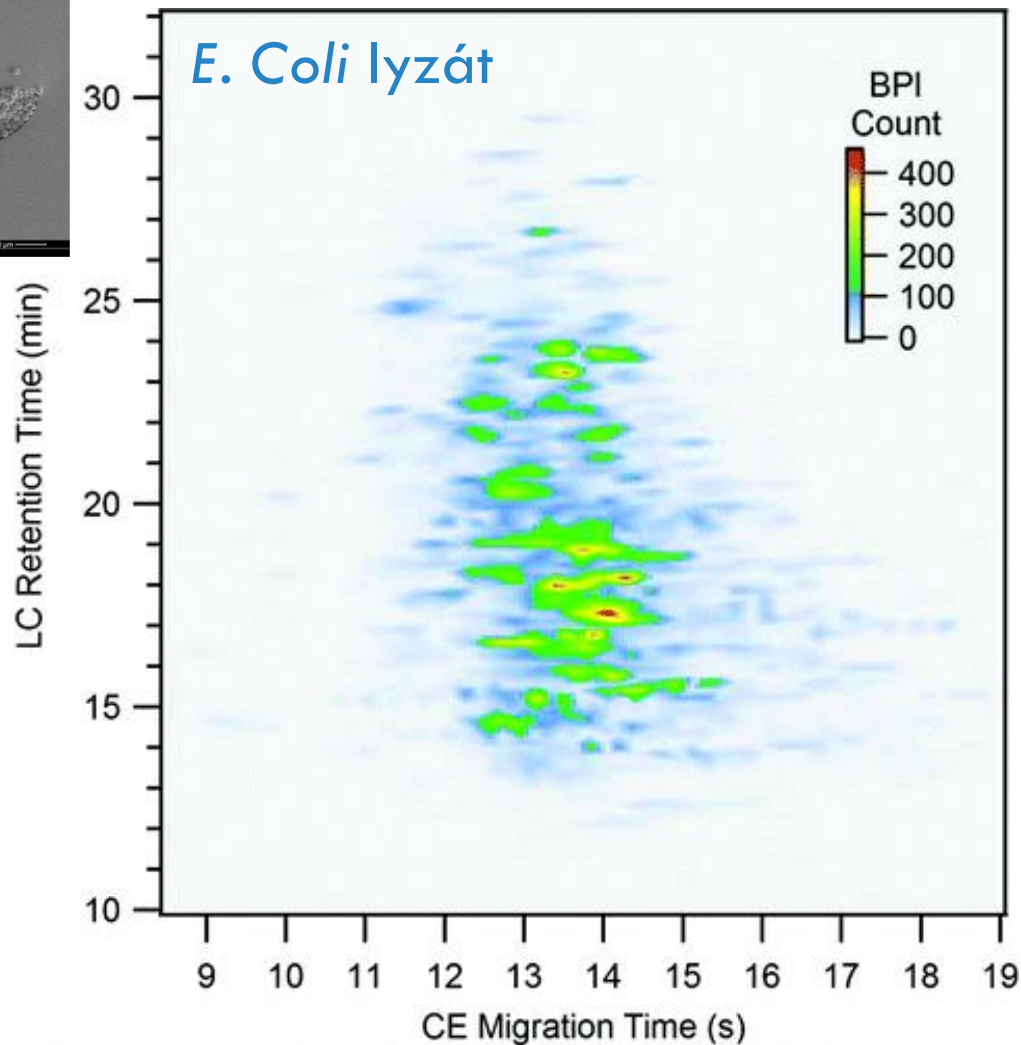
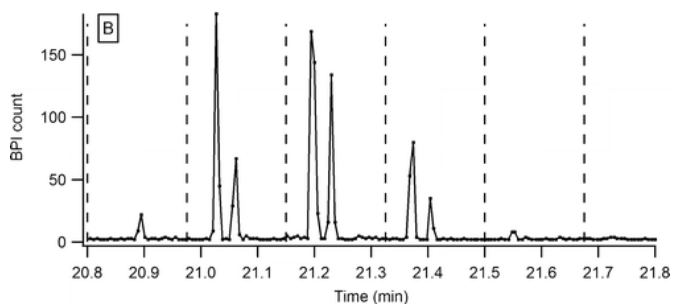
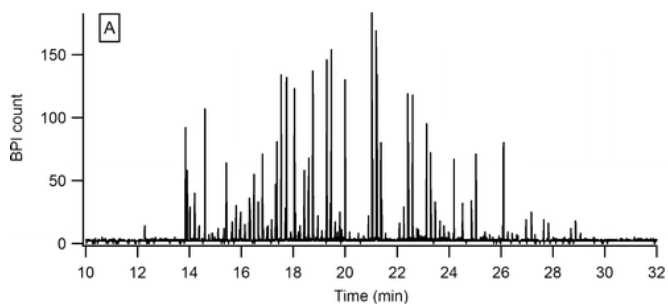
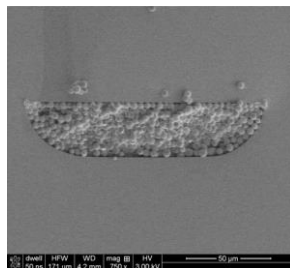
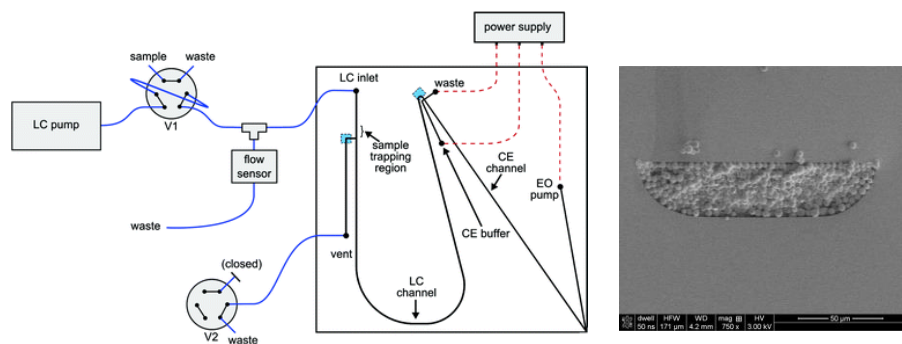
UPLC- μ CE-MS



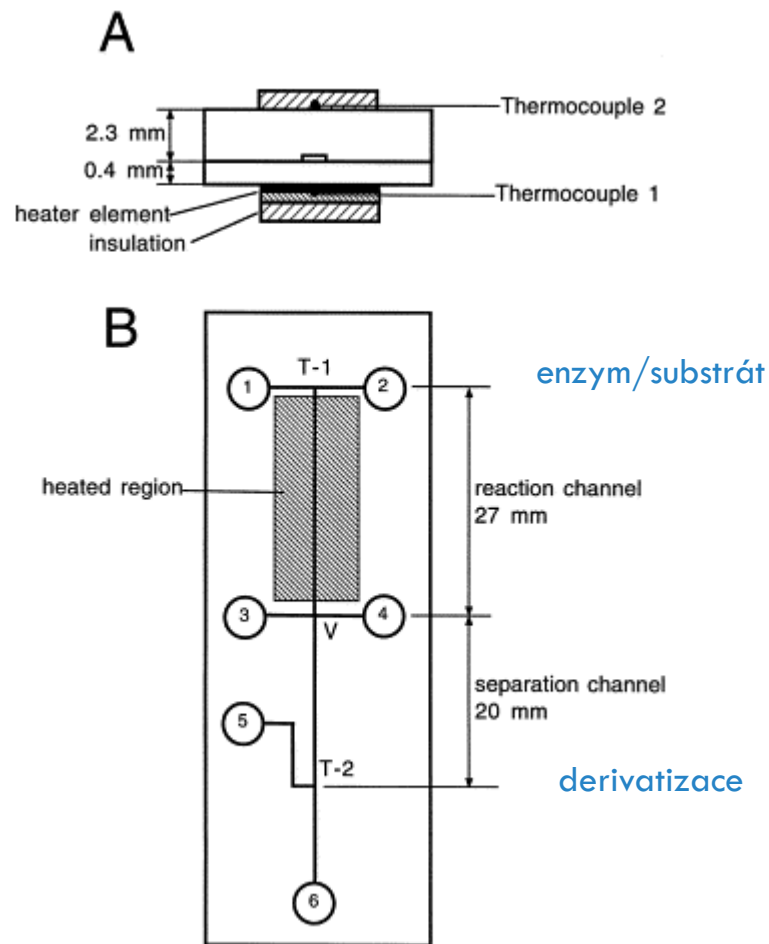
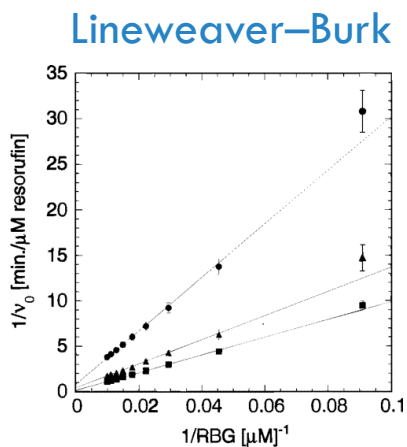
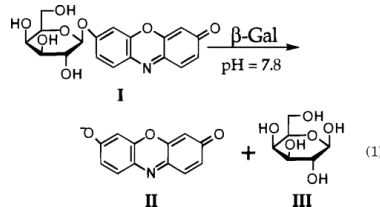
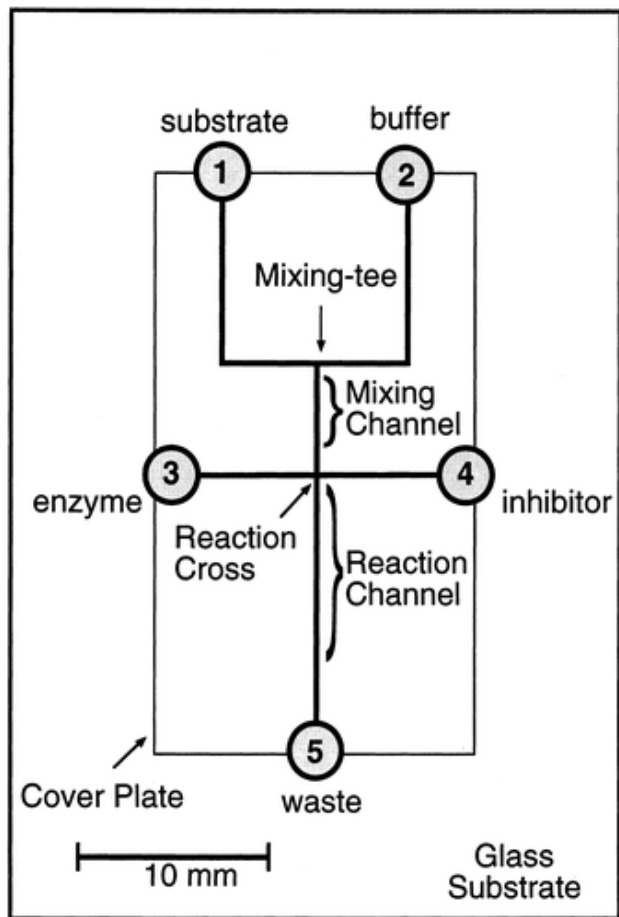
Digested IgG2



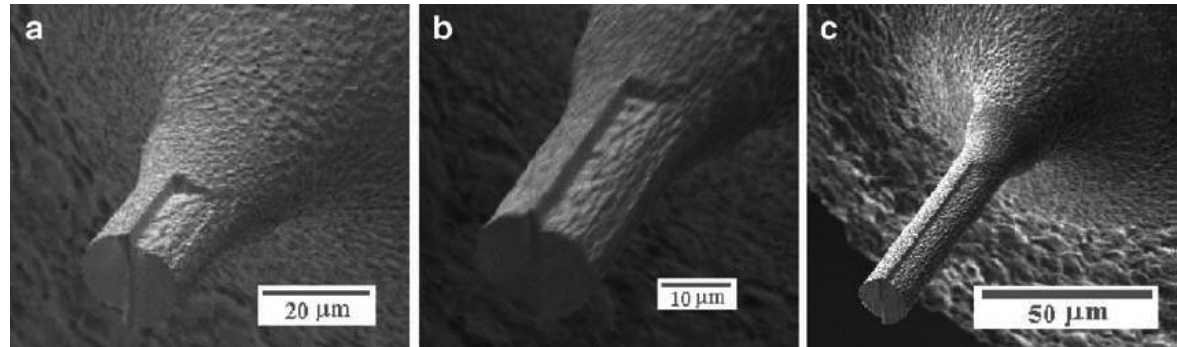
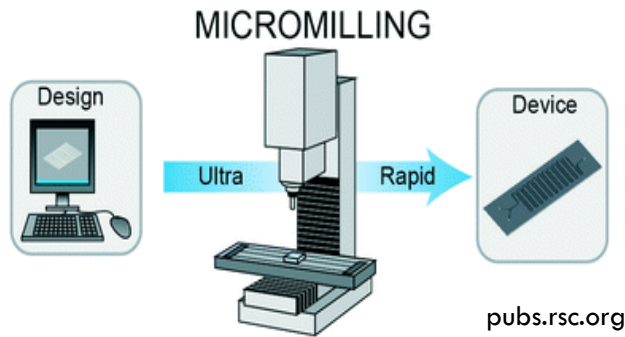
LC-EC-ESI



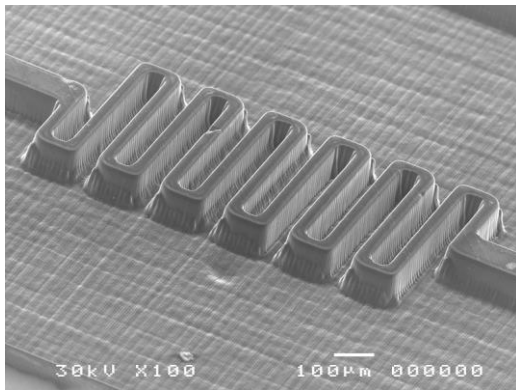
ENZYMATICKÉ STUDIE



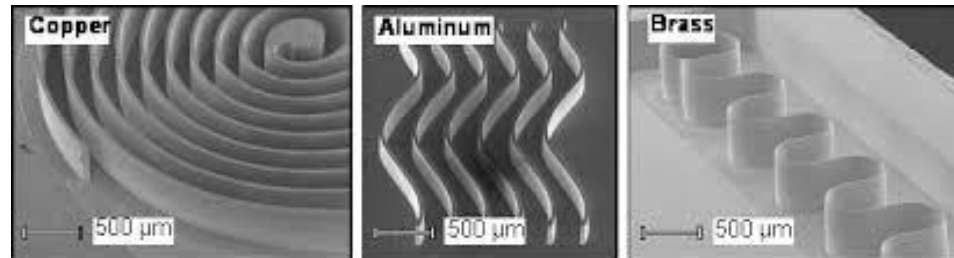
FRÉZOVÁNÍ (MICROMILLING)



Int. J. Adv. Man. Techn. 31(2006) 501-508.



www.oxfordlasers.com

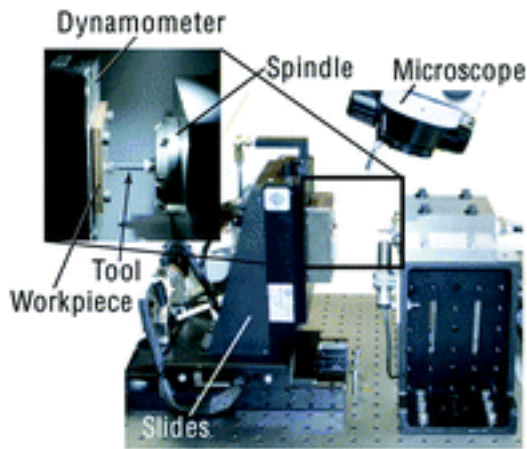


www.sfb516.tu-bs.de



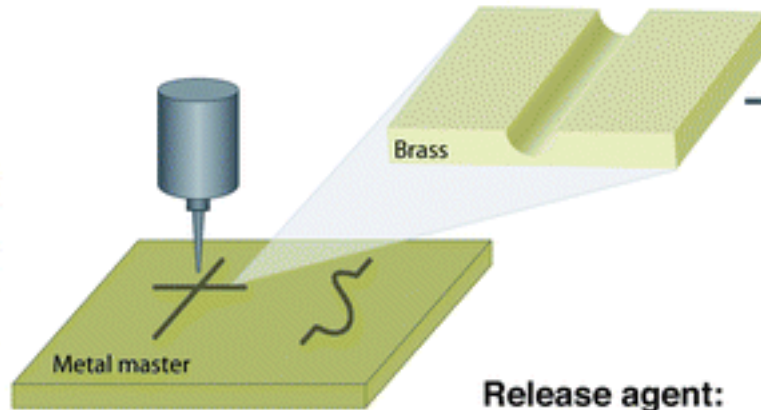
www.cnc.info.pl

FRÉZOVÁNÍ A LITOGRAFIE

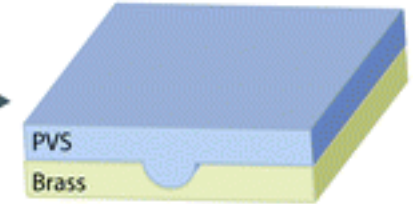


Miniature Machine Tool (MMT)

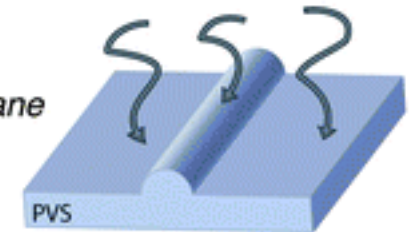
A. Micromilled metal master with semi-circular cross-section channels



B. Positive PVS mold

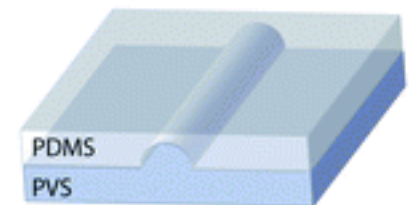


C. Surface passivation

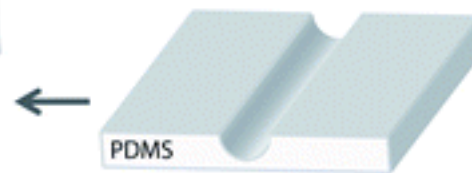


Release agent:
*Fluorinated trichlorosilane
or 1% gelatin solution*

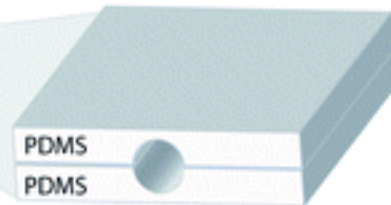
D. PDMS molding



E. Negative PDMS mold

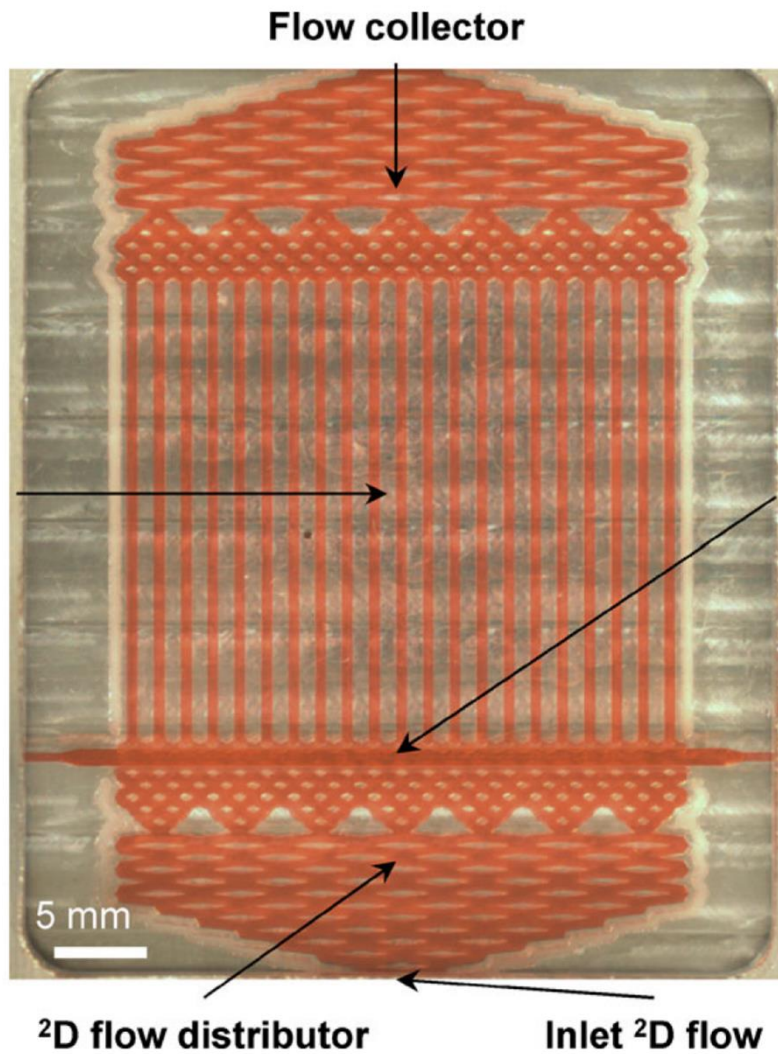


F. Circular channel assembly from two PDMS slabs

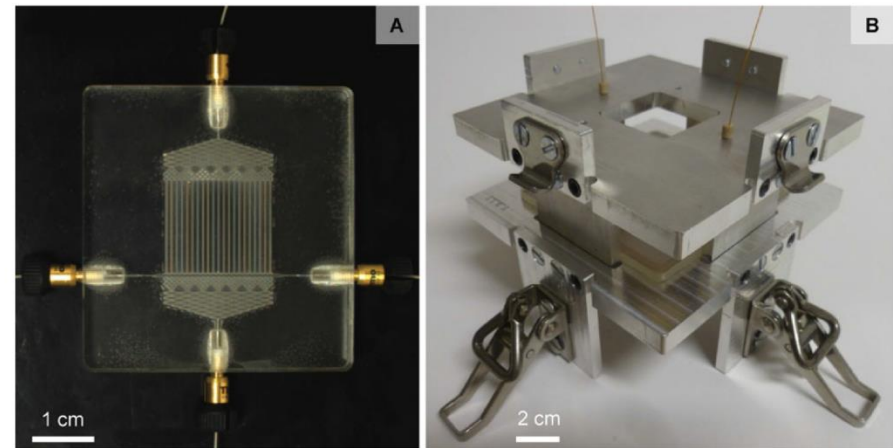
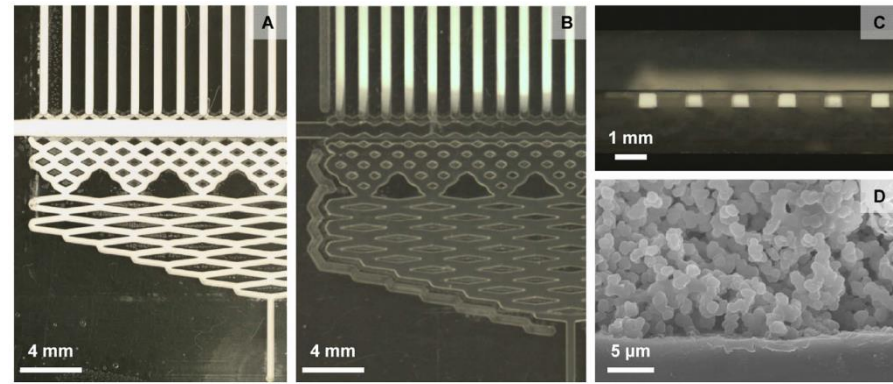


MICROFLUIDNÍ 2D-LC

21 2D separation channels



1D separation channel



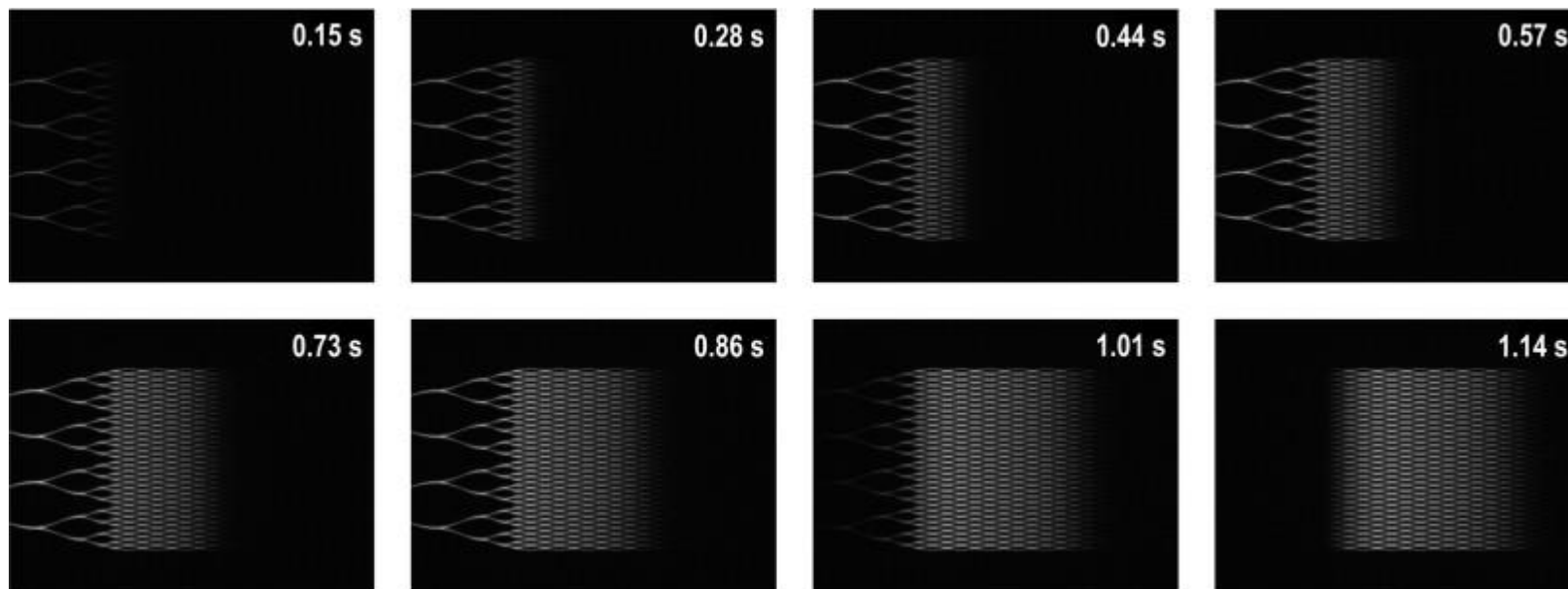
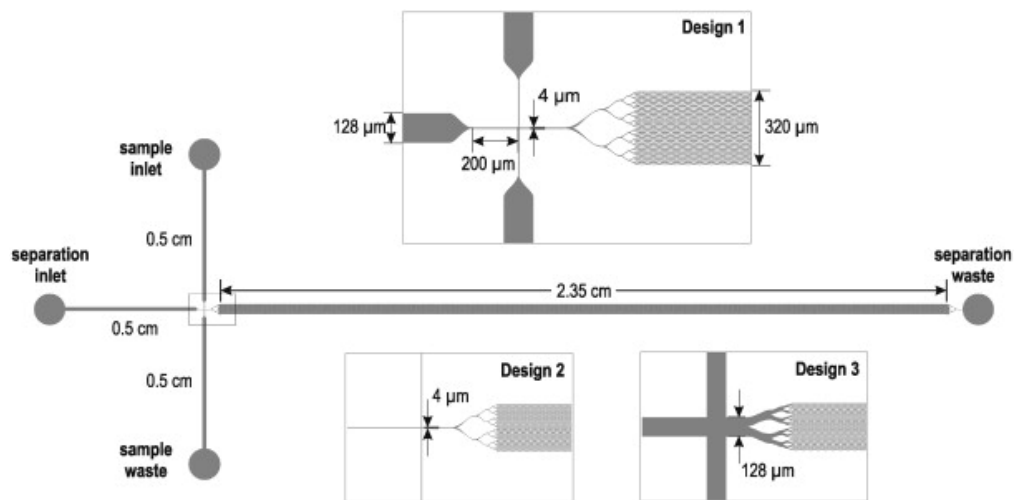
MICROFLUIDNÍ 2D-LC



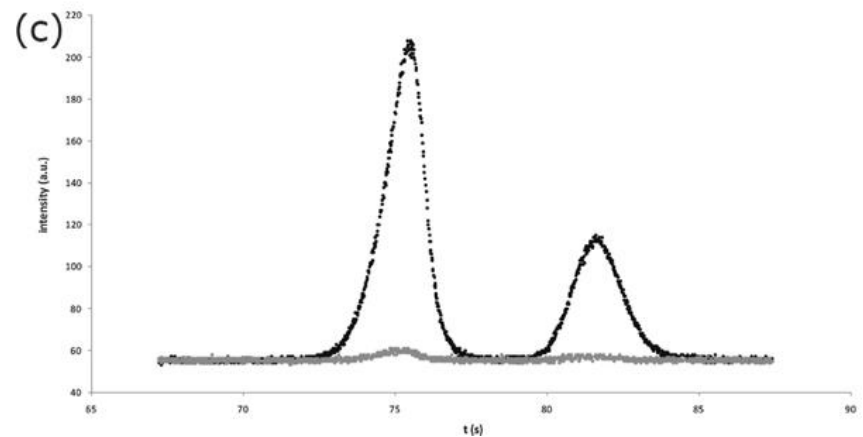
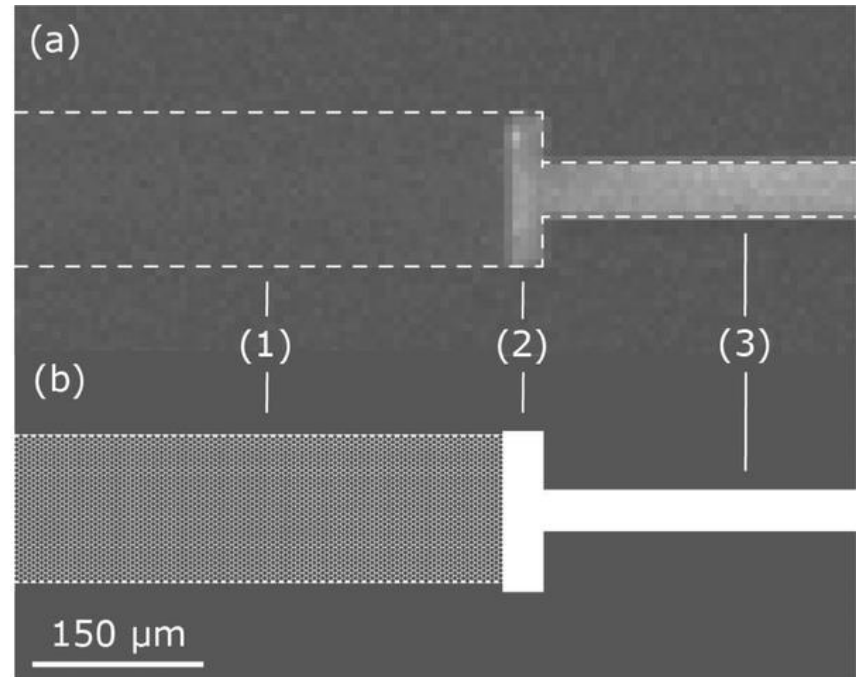
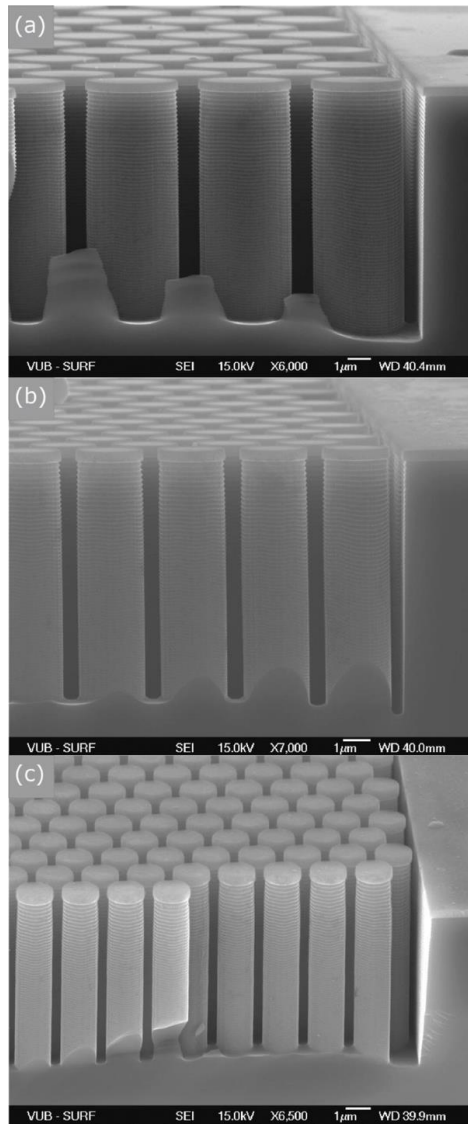
MICROFLUIDNÍ 2D-LC



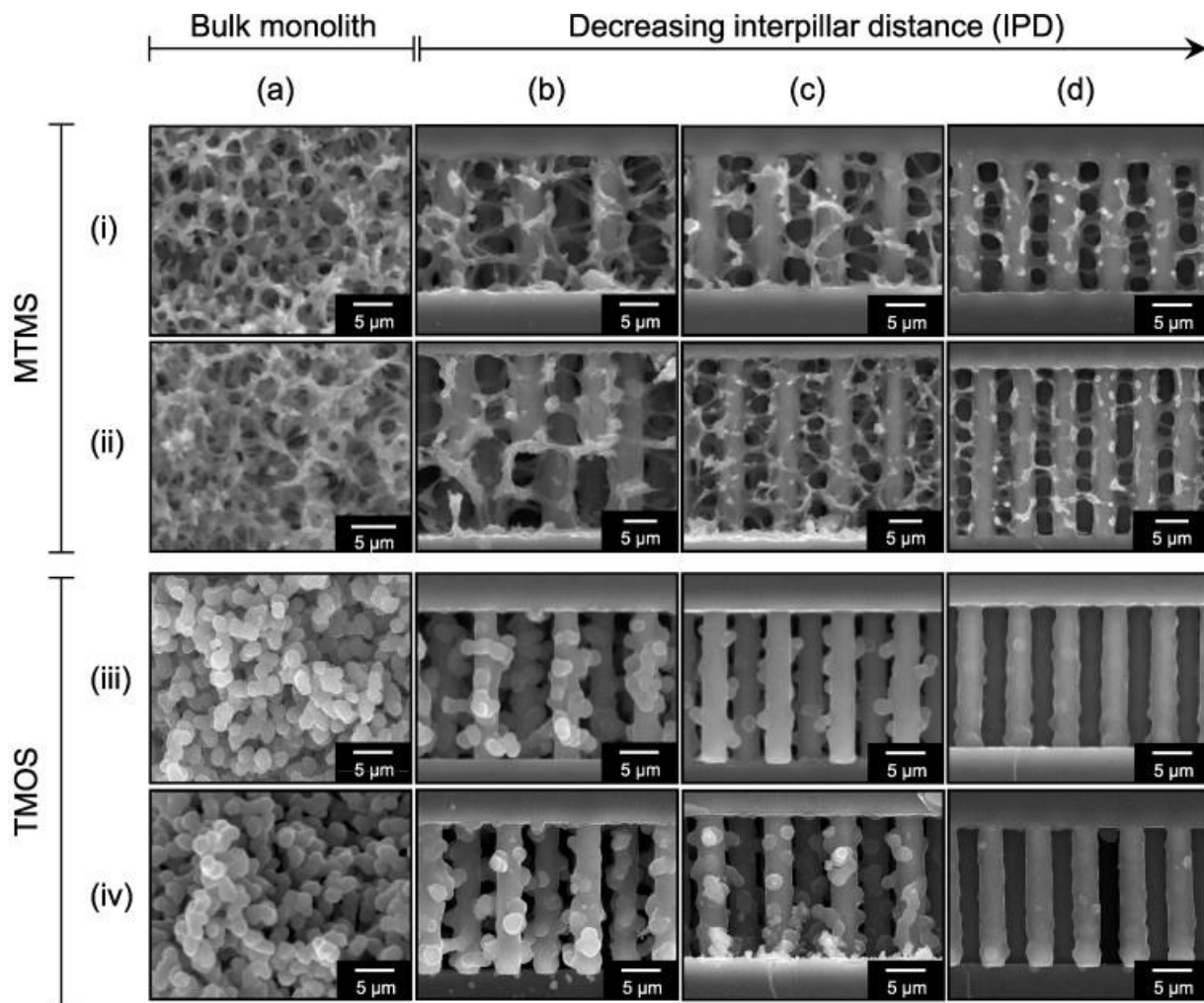
DISTRIBUCE TOKU



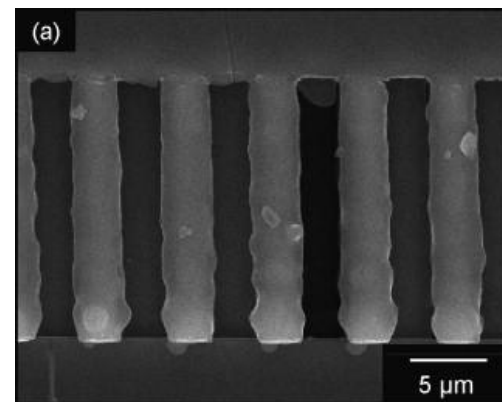
PILÍŘE (PILLARS)



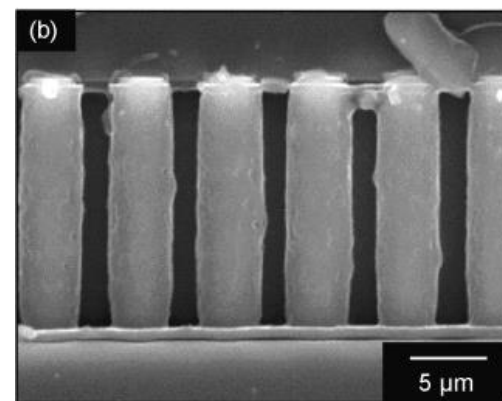
PILÍŘE A PORÉZNÍ MONOLIT



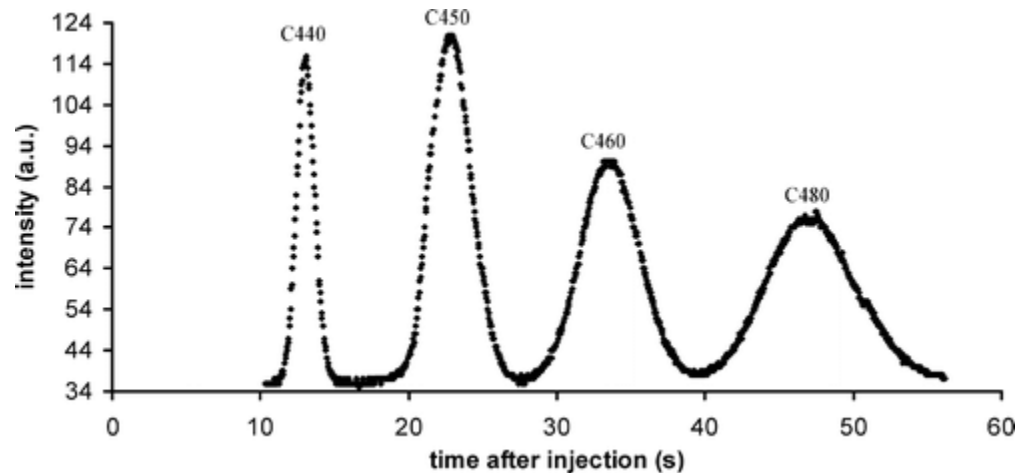
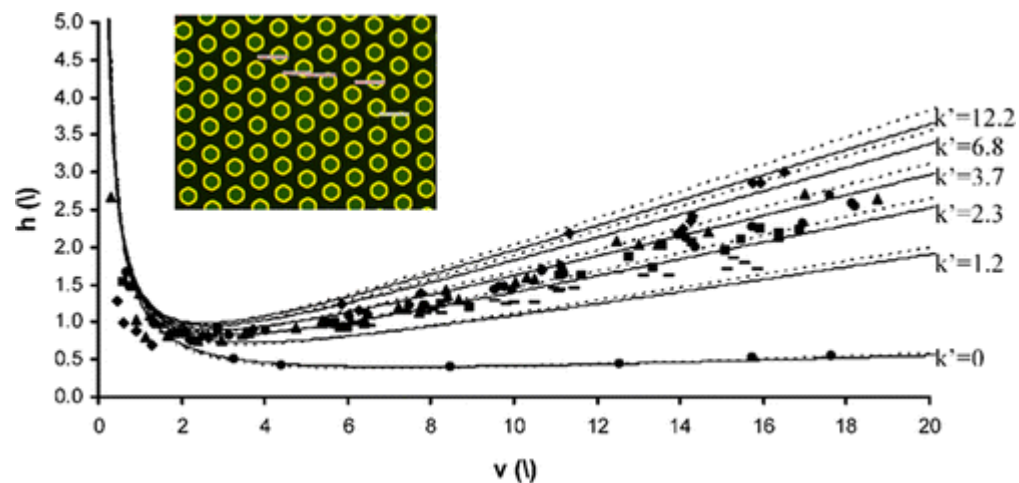
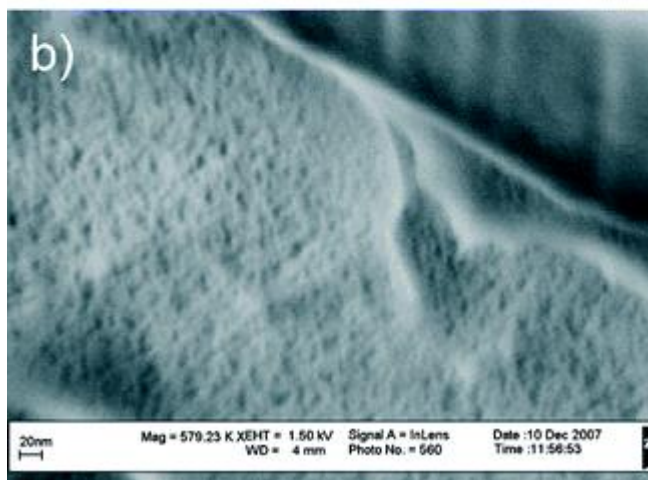
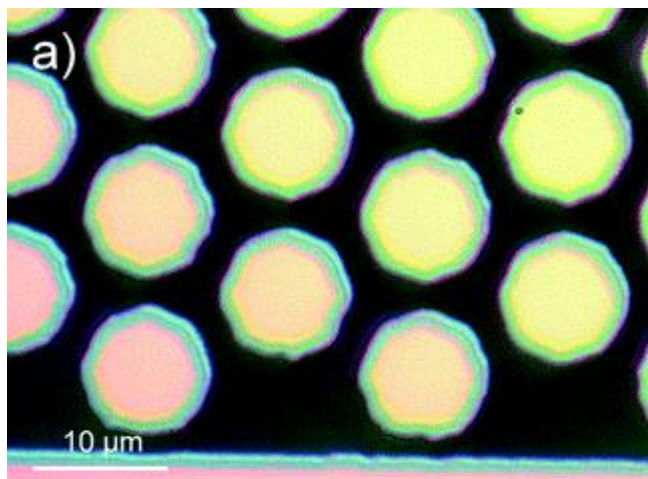
Jedna vrstva



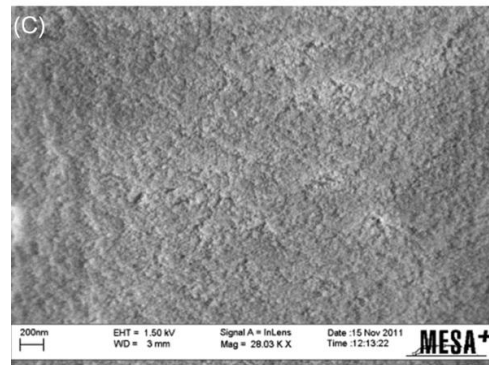
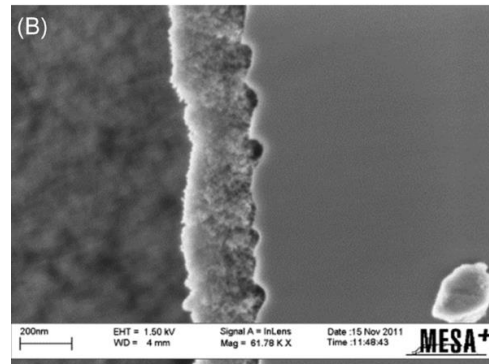
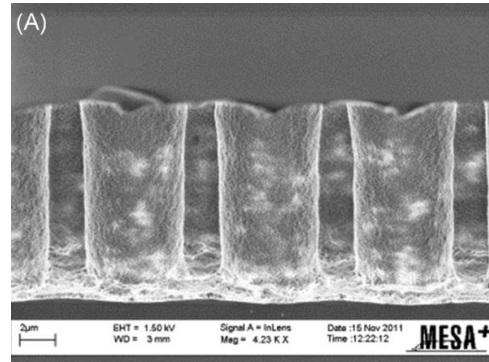
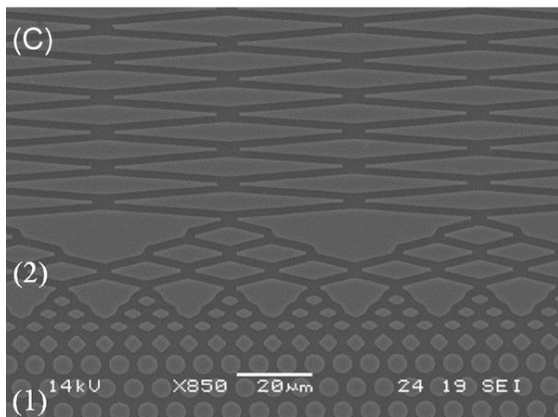
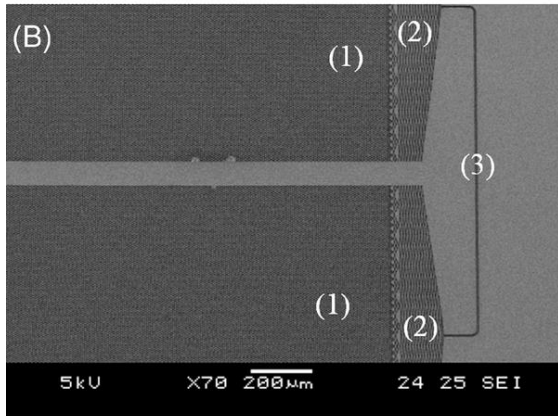
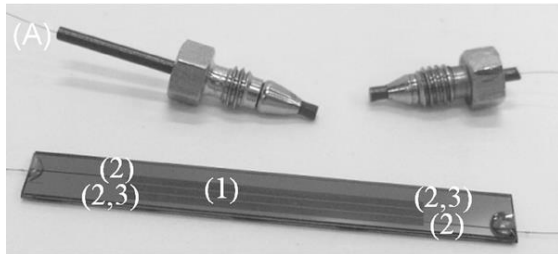
Druhá vrstva



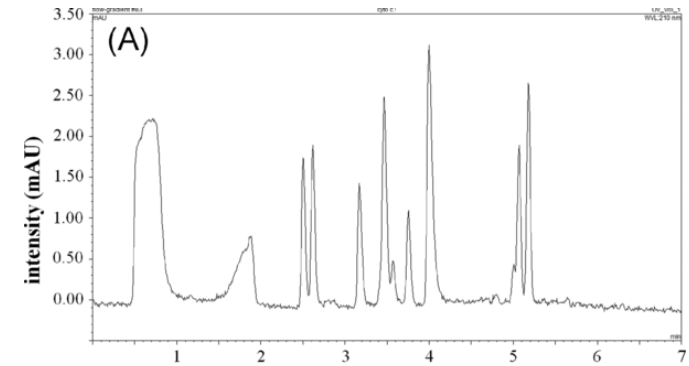
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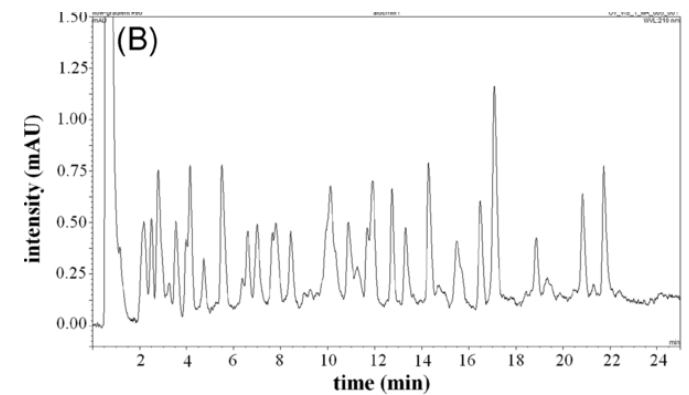
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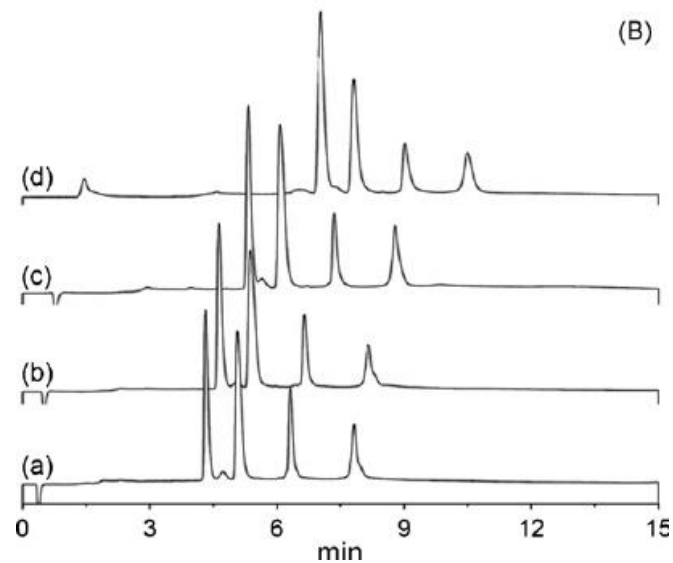
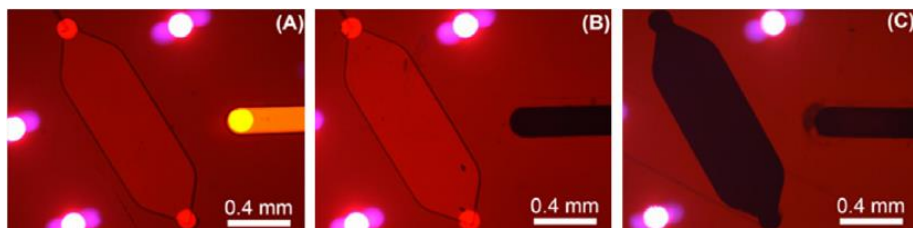
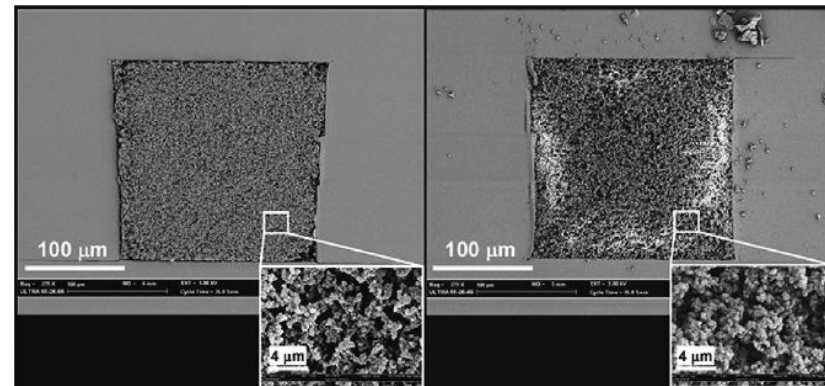
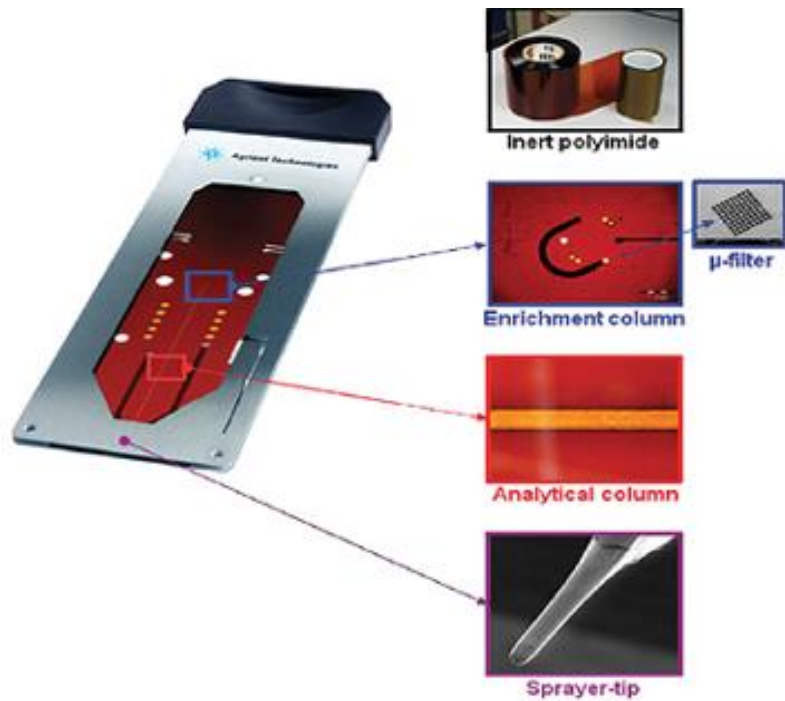
Cytochrome C



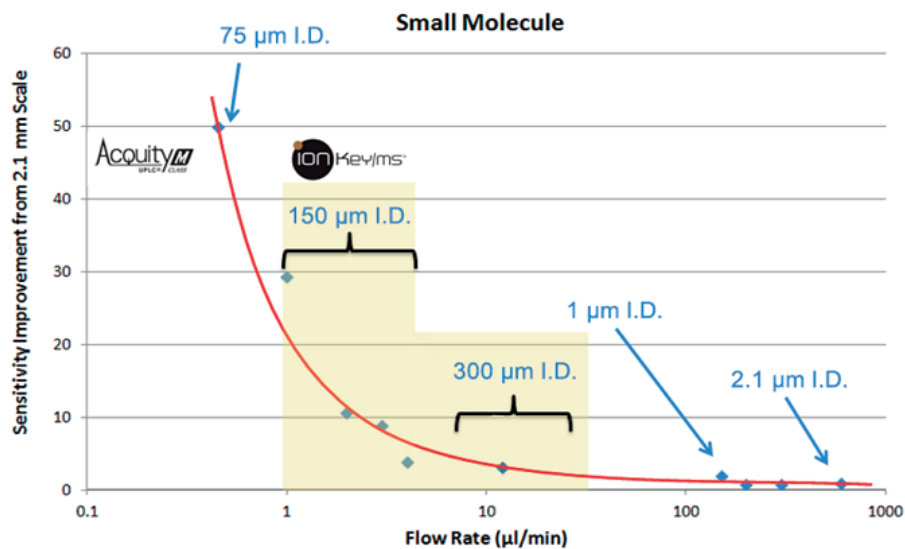
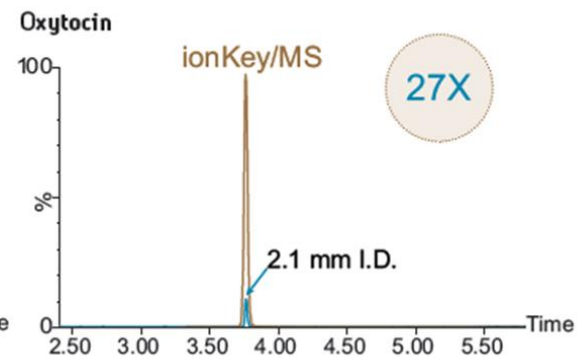
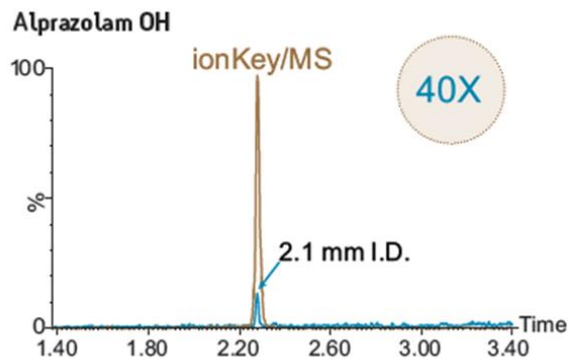
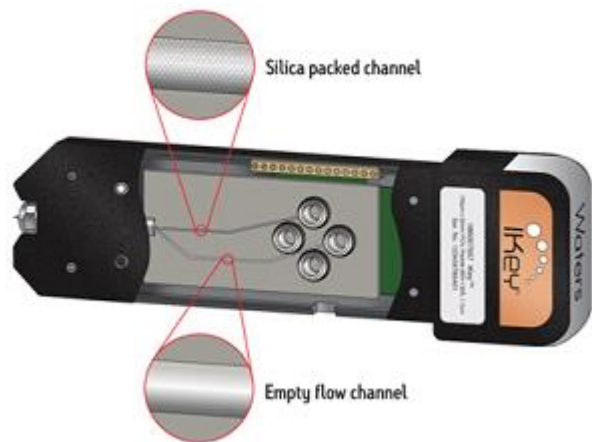
Albumin



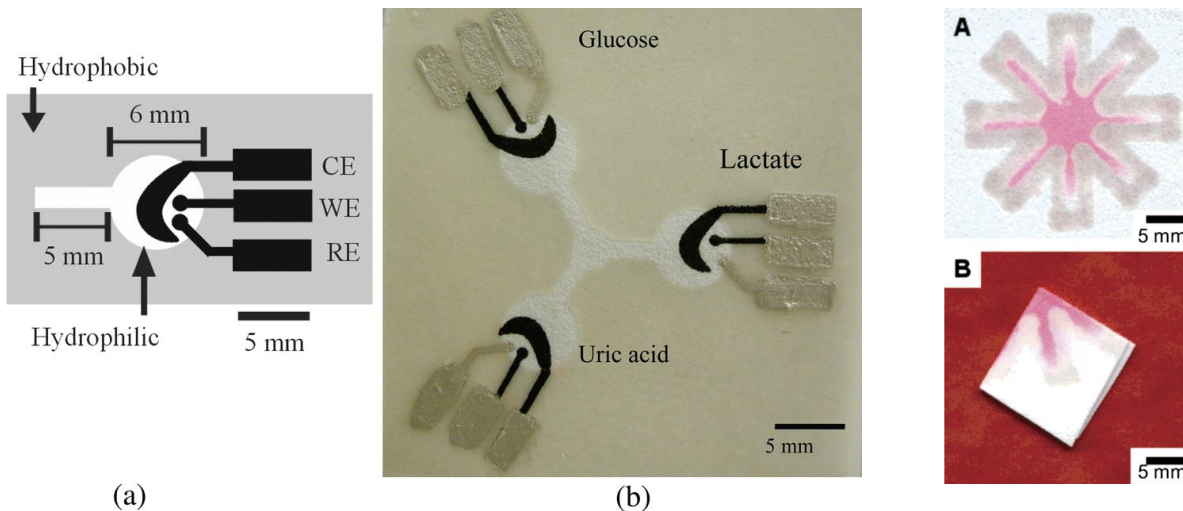
AGILENT HPLC/MS CHIP



WATERS IONKEY/MS

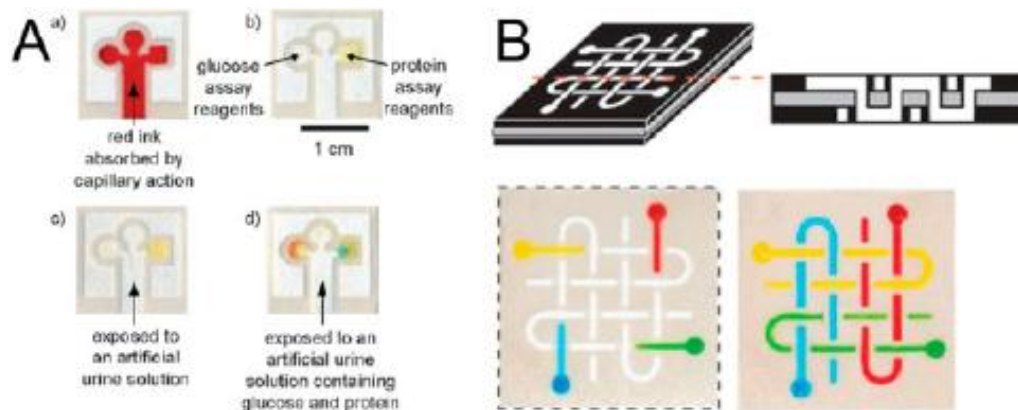


„PAPÍROVÁ“ DIAGNOSTIKA



(a)

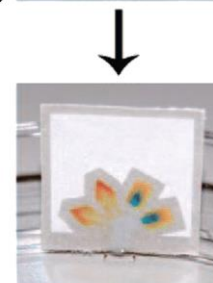
(b)



The entrance to the microfluidic device is dipped into urine.



Urine wicks into the assay zones.



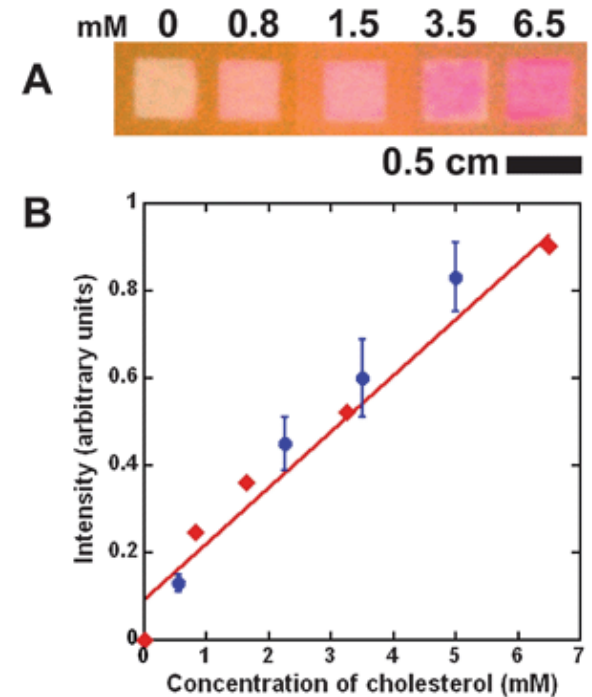
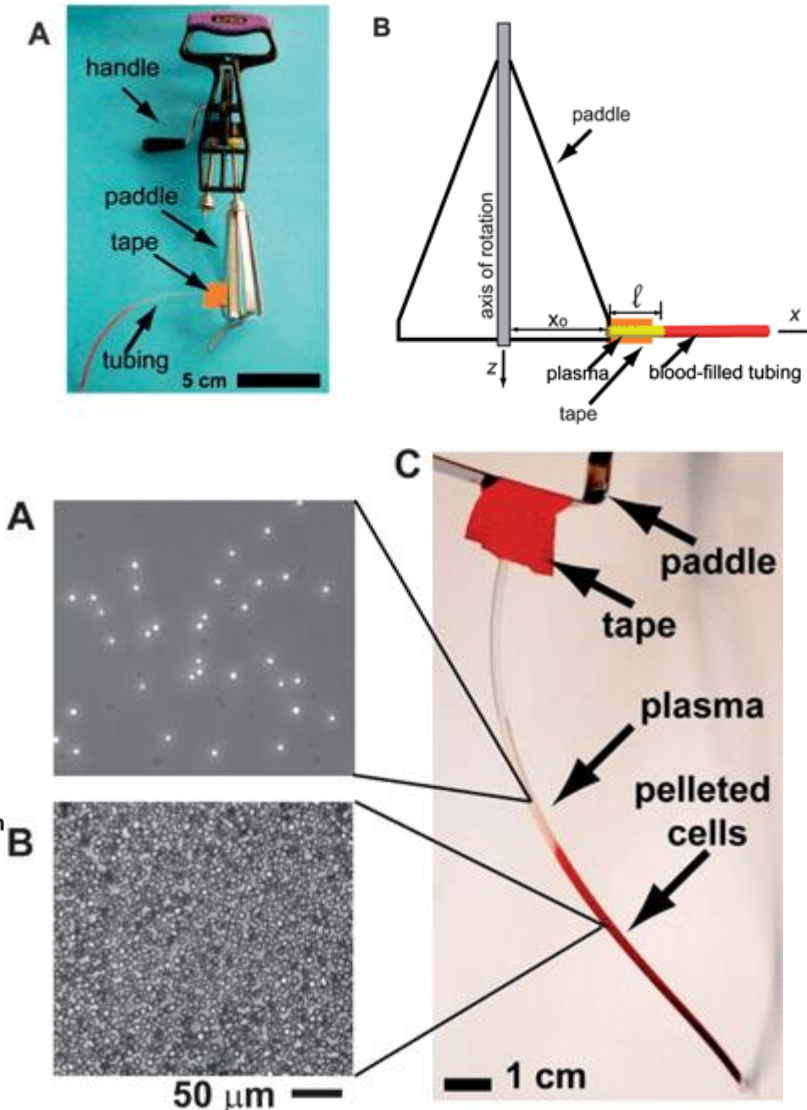
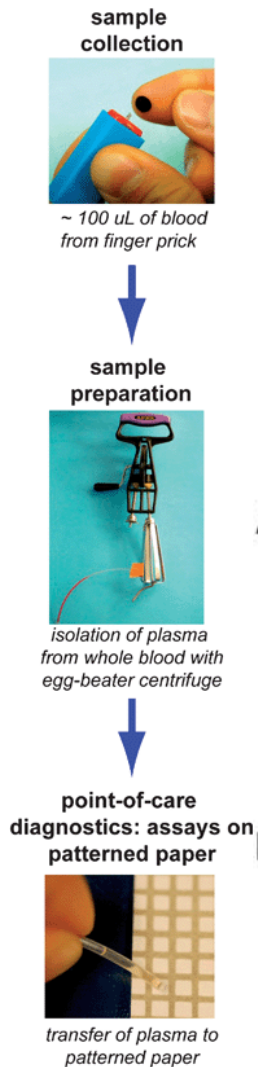
An imaging device digitizes the results and transmits them to an expert.



An expert interprets the results, and replies with a treatment.

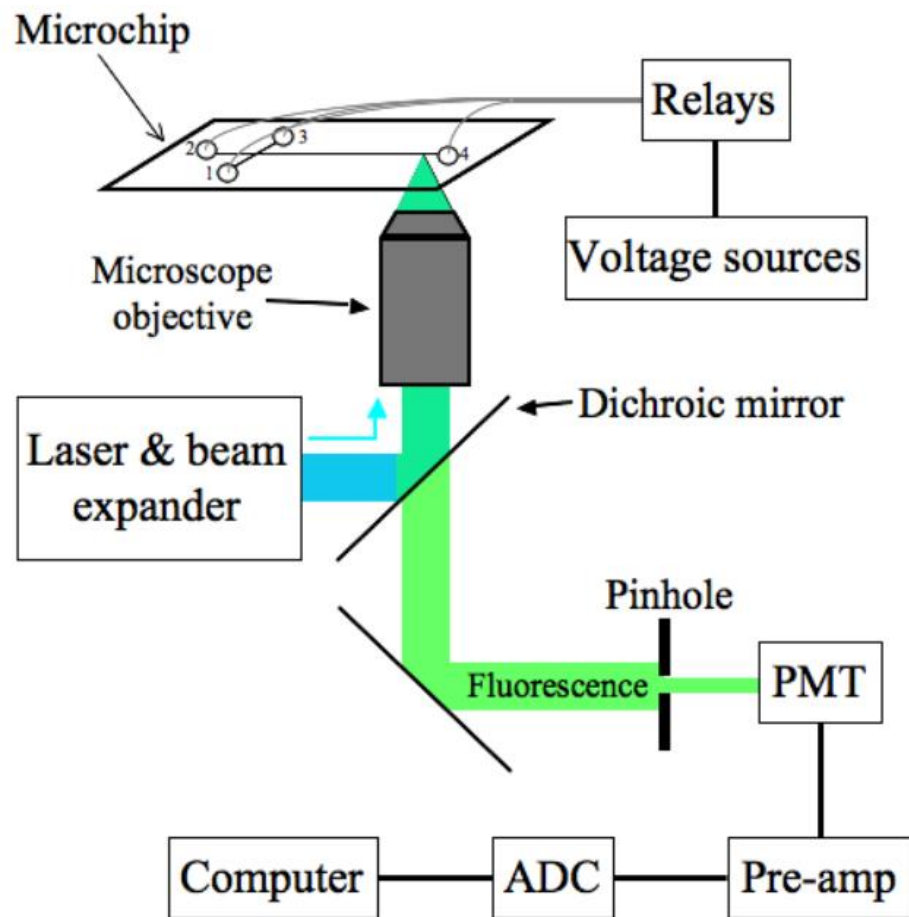


(NELABORATORNÍ) CENTRIFUGA

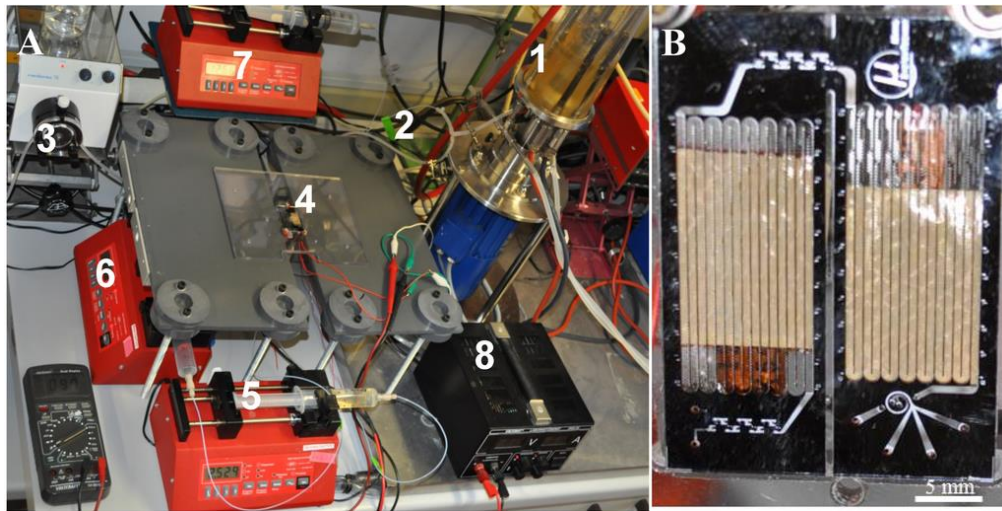


George M. Whitesides

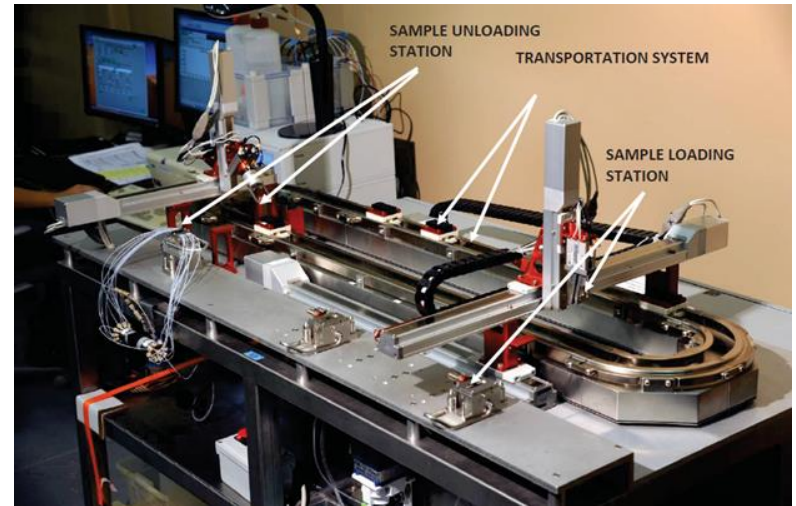
LASEREM INDUKOVANÁ FLUORESCENCE (LIF)



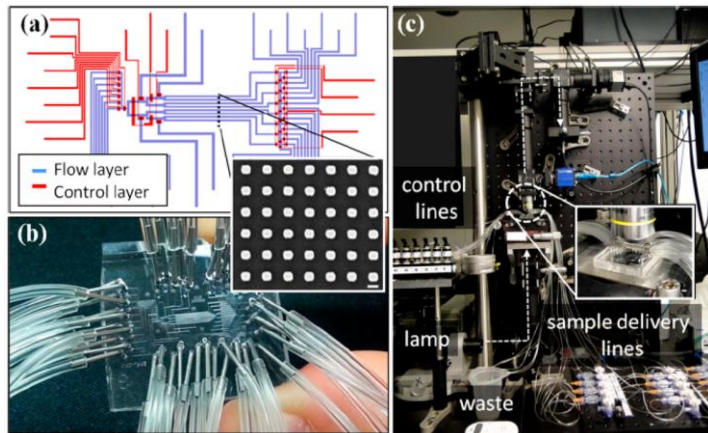
MICROFLUIDICS (?)



Cells 2 (2013) 349-360.



www.osti.gov



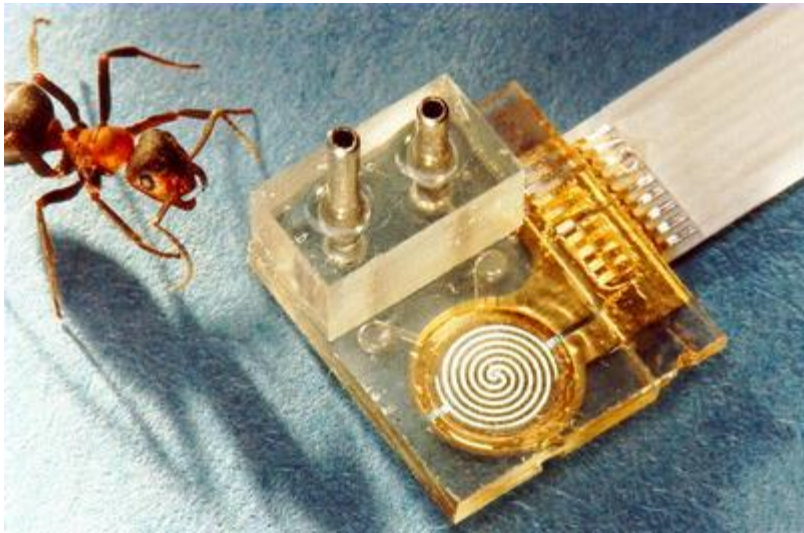
Sensors 15 (2015) 15684-15716.



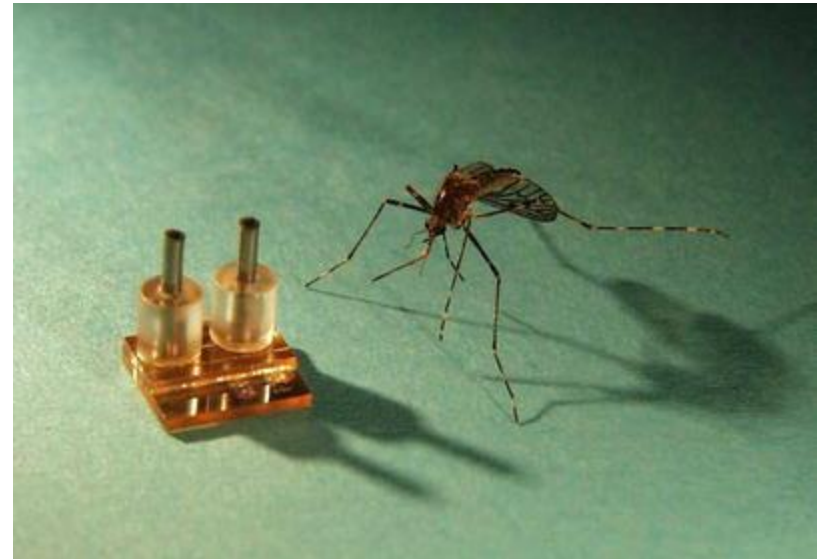
biomems.rutgers.edu

INTEGROVANÉ SYSTÉMY

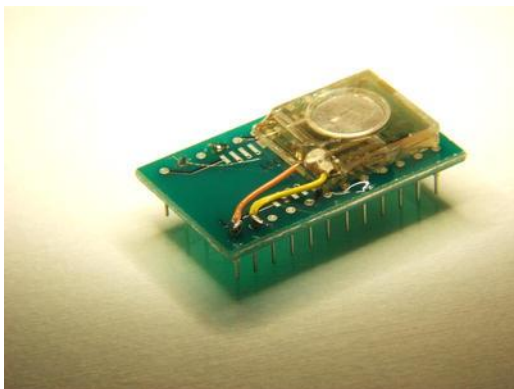
Mikročerpadlo



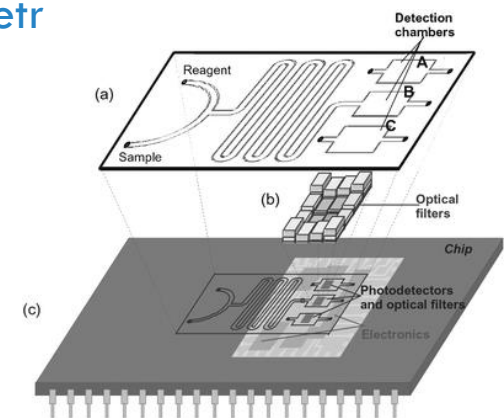
Kontrola toku



Kontrola toku

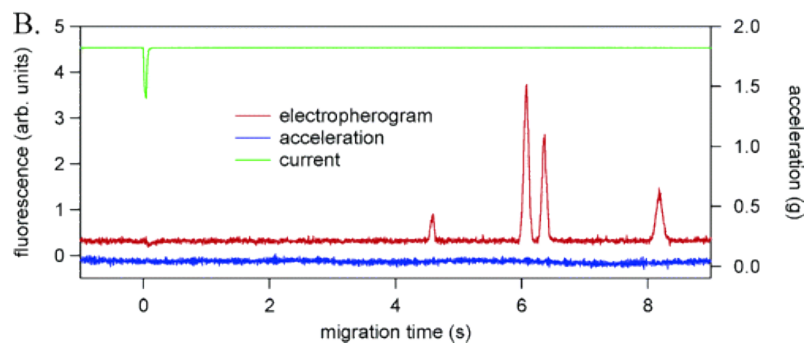
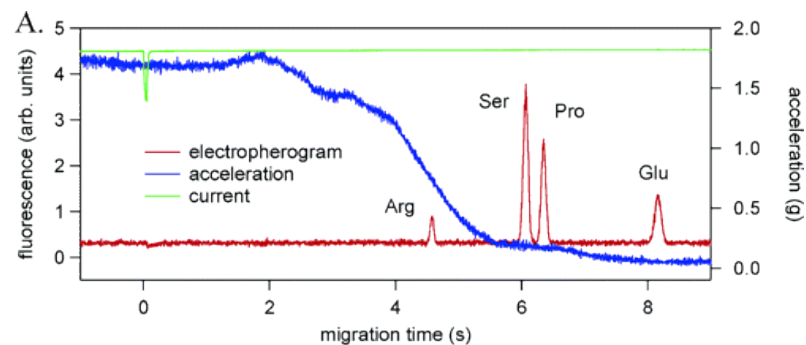
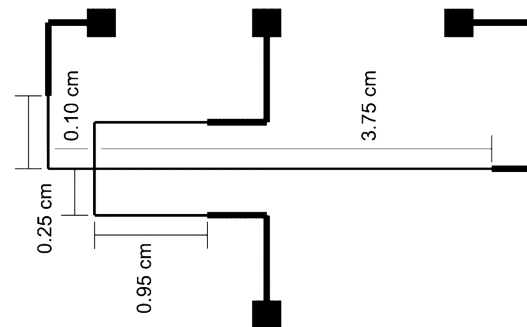
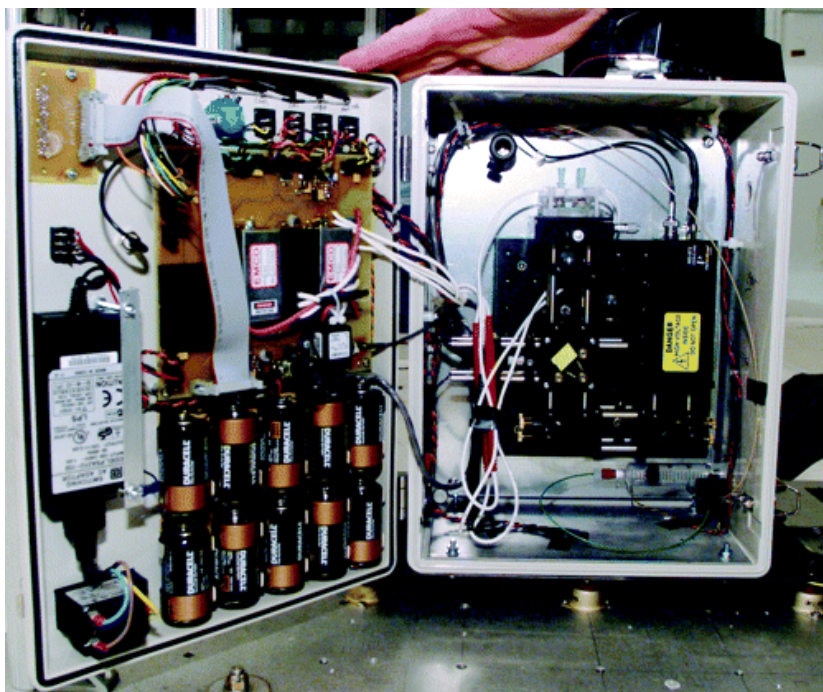


Spektrofotometr

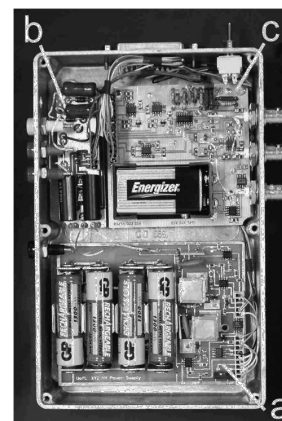
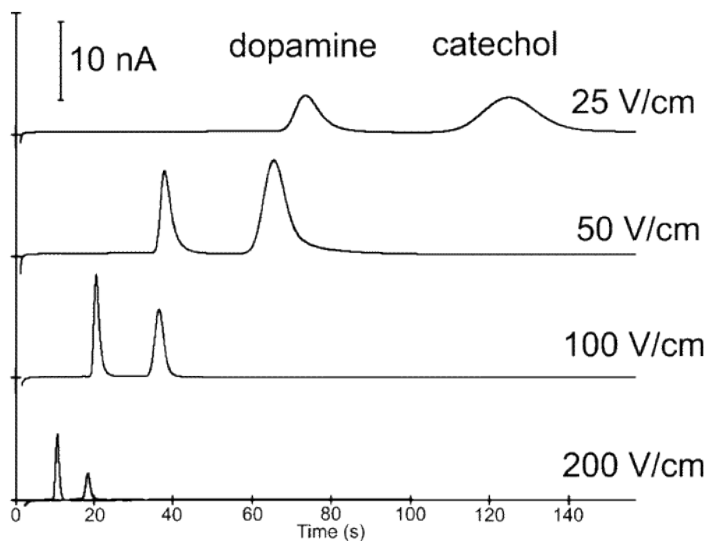
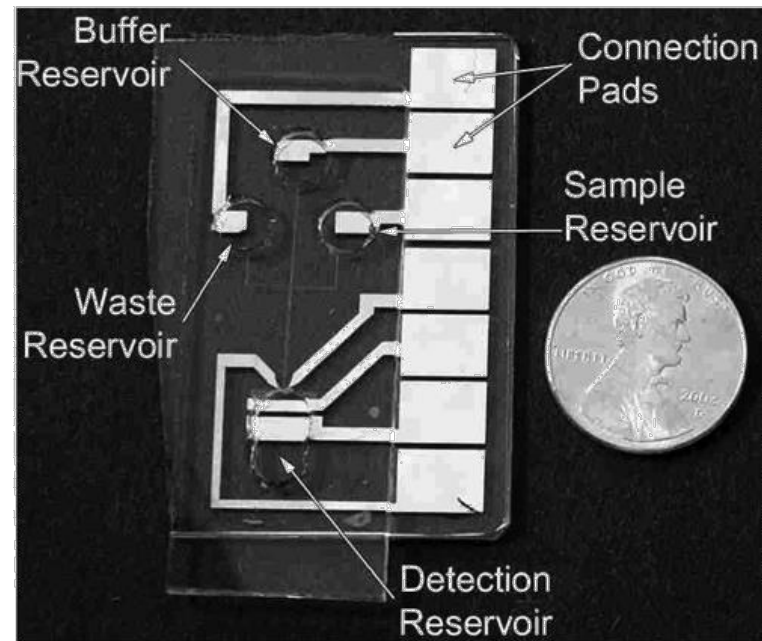
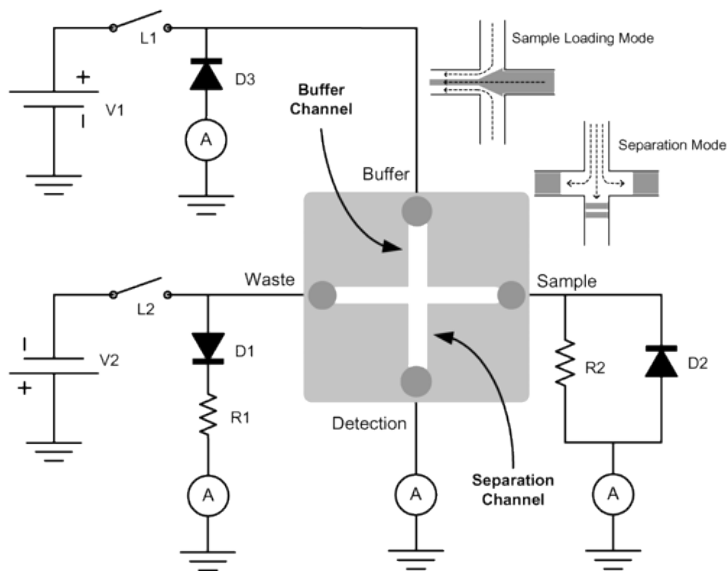


INTEGROVANÉ SYSTÉMY

Aminokyseliny
při snížené a zvýšené gravitaci

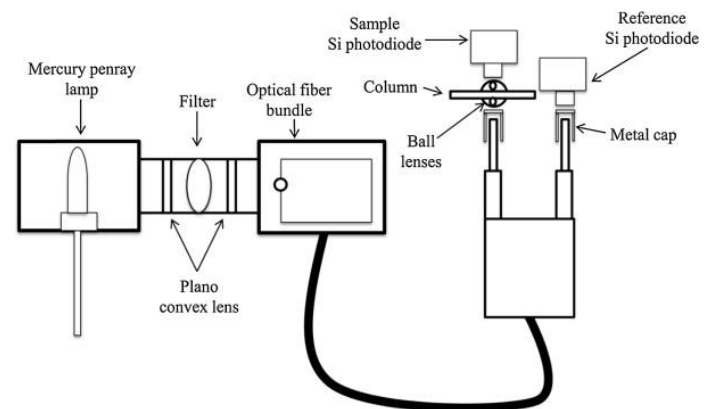
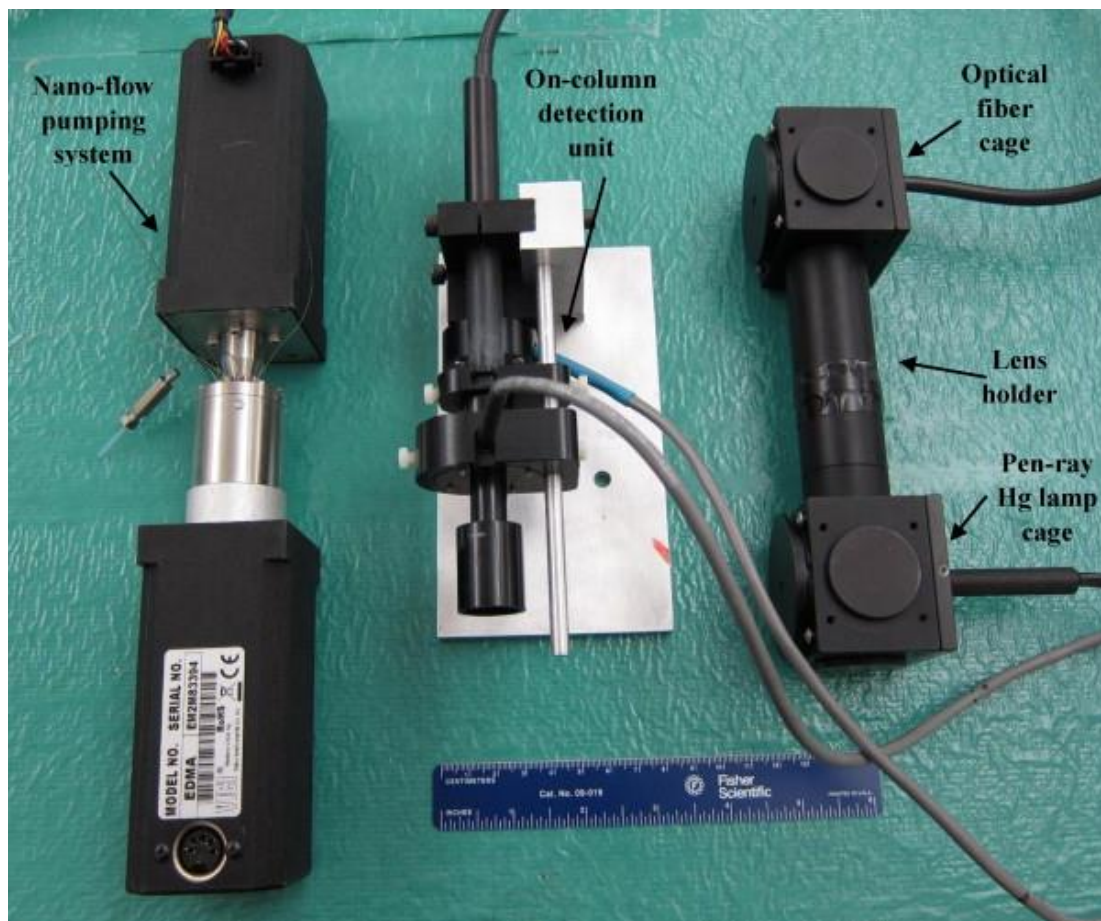


PŘENOSNÉ SYSTÉMY



CE – ECD

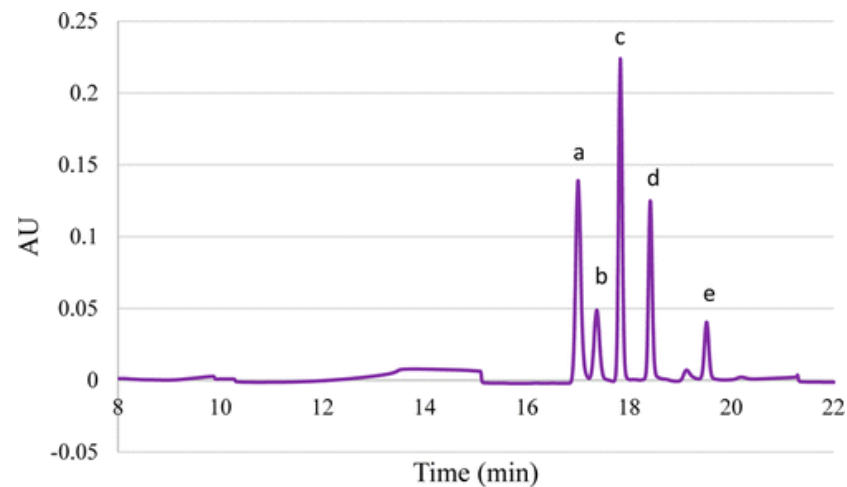
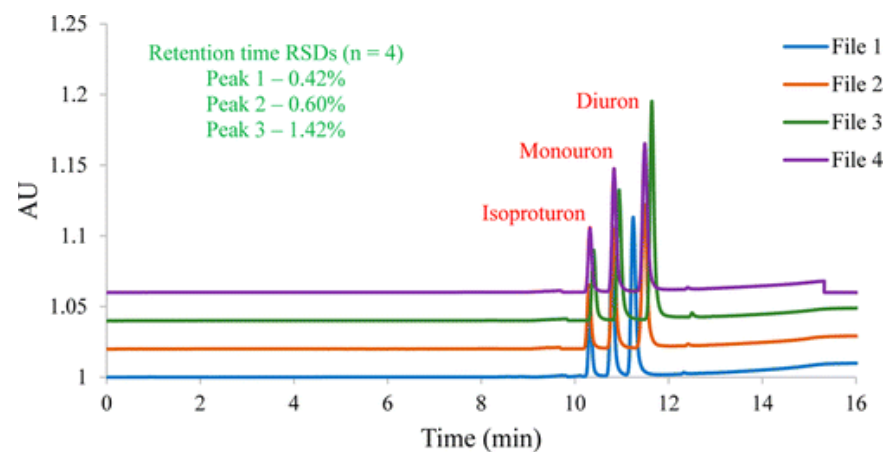
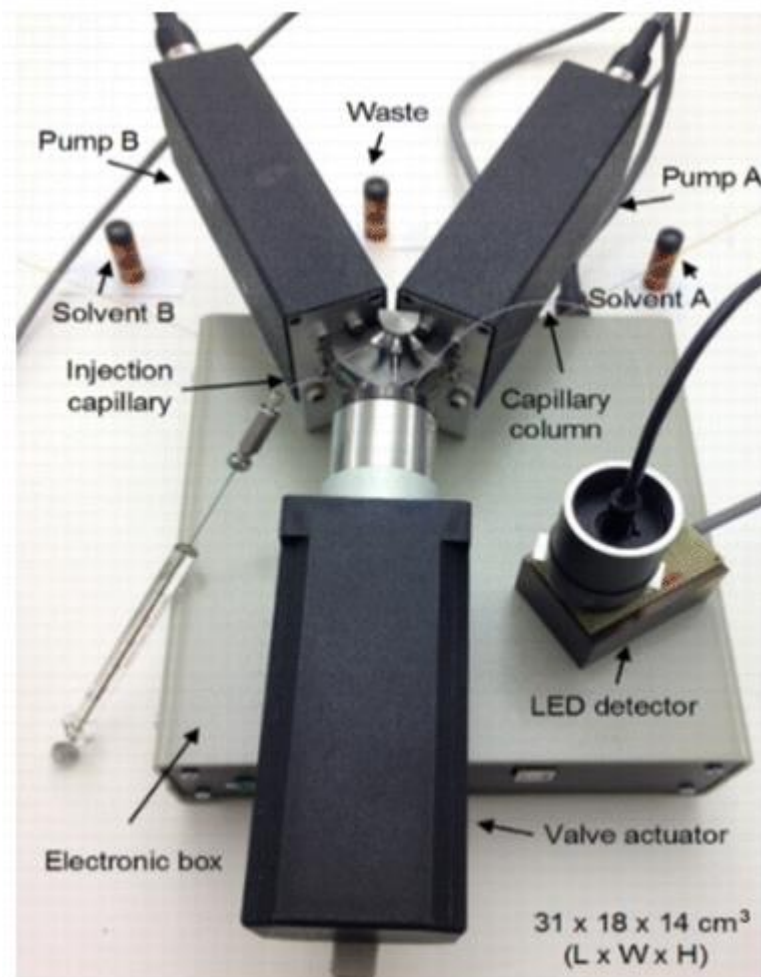
PŘENOSNÉ SYSTÉMY



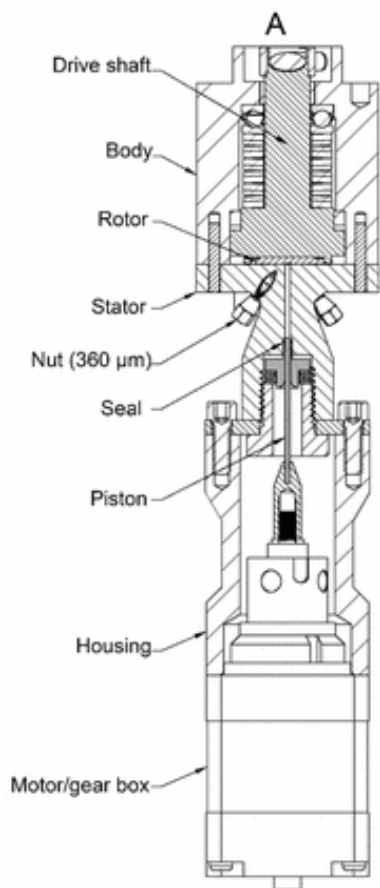
Monolitická kapilární kolona
155 x 0.075 mm

LC – UV

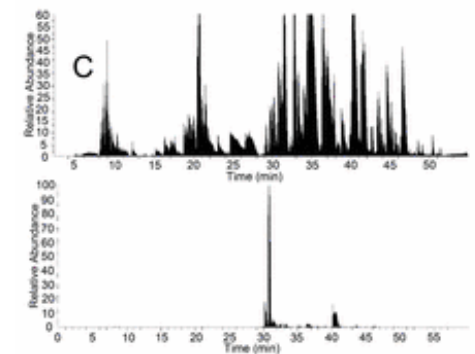
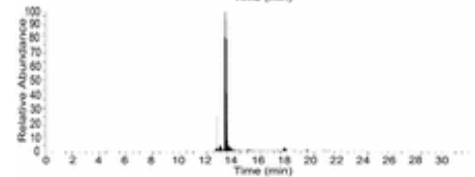
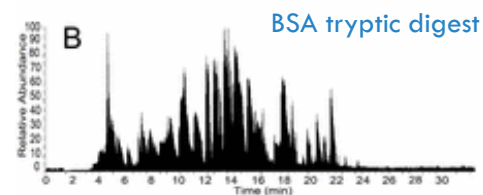
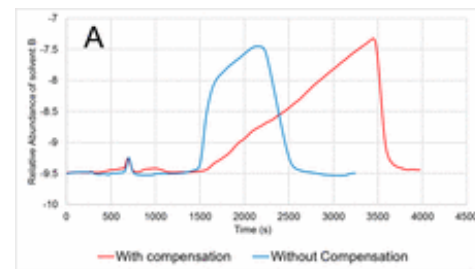
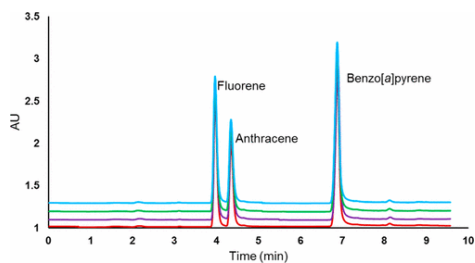
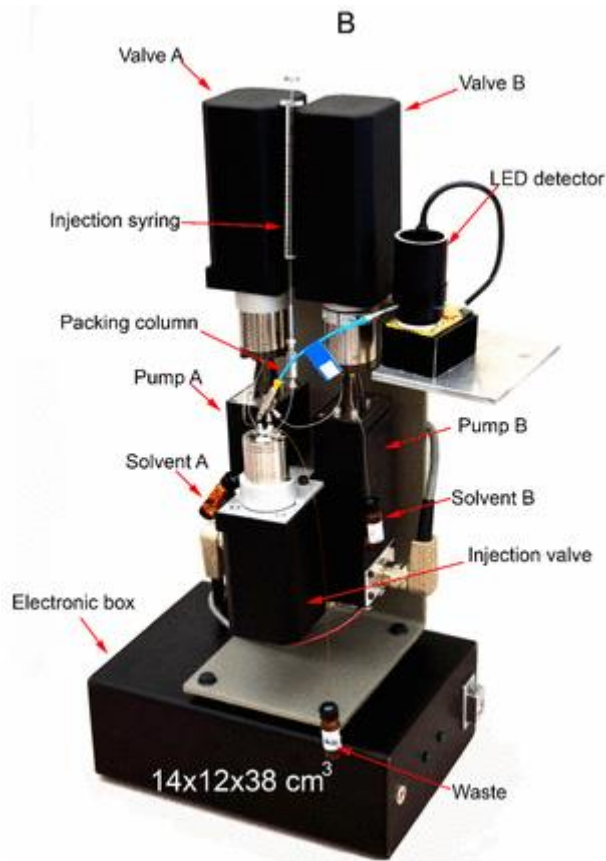
PŘENOSNÉ SYSTÉMY



PŘENOSNÉ SYSTÉMY

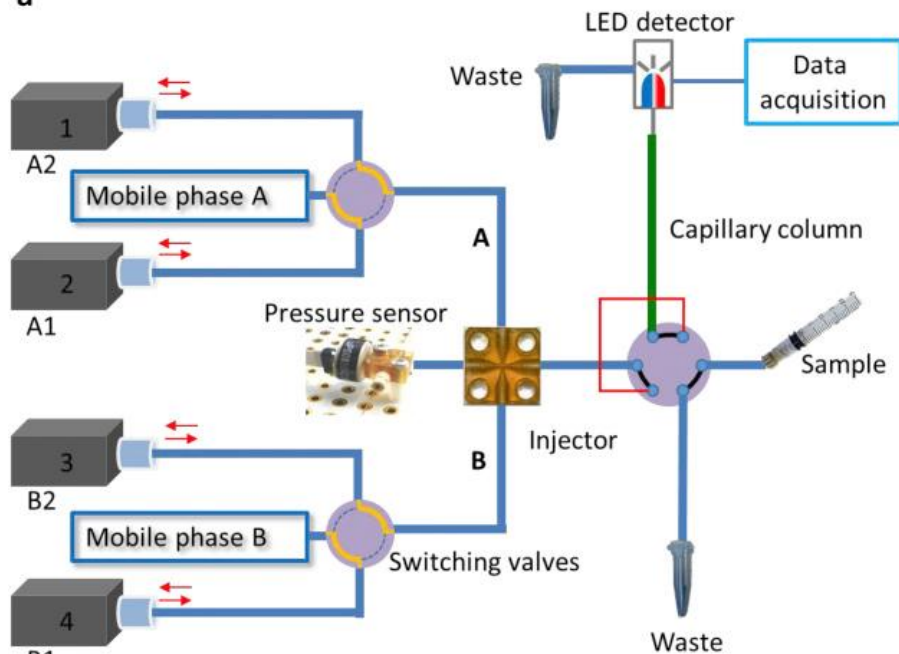


~ 1100 bar



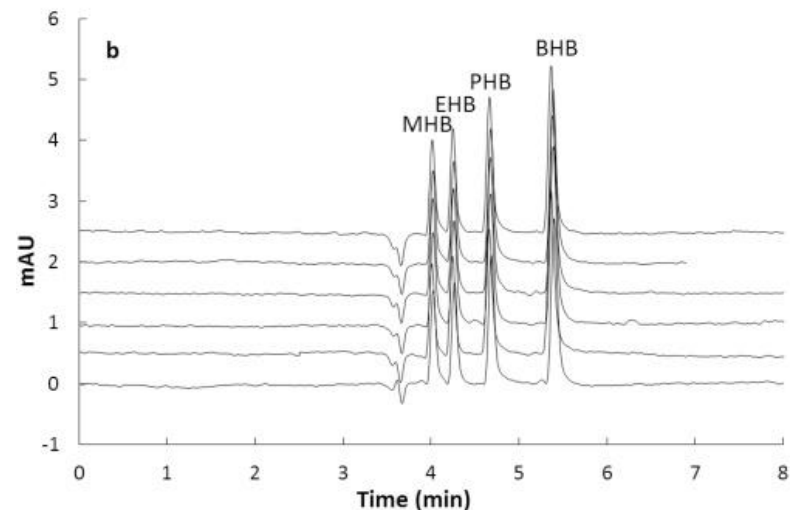
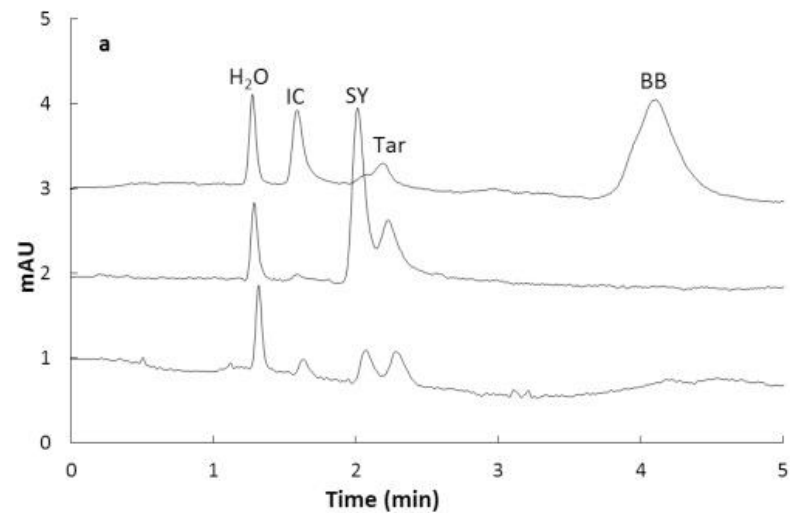
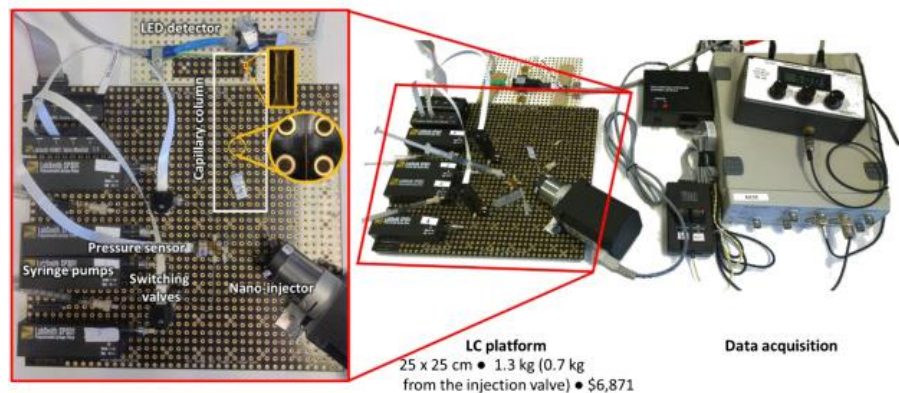
PŘENOSNÉ SYSTÉMY

a



~ 7 000 USD
~ 175 000 CZK

b





“Simplicity, for reasons that are a little bit obscure, is almost not pursued, at least in the academic world.”

George M. Whitesides