

# Organ-on-chip devices

PhD Report – 2nd semester

Lilia Bató

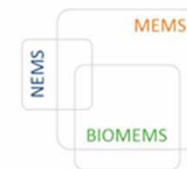
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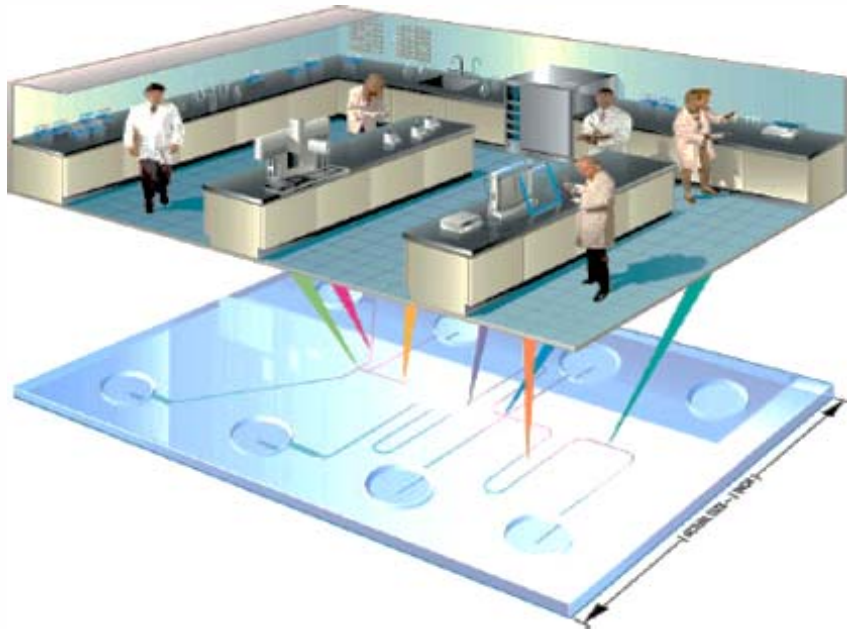
# Introduction

- Microfluidics: precise control and manipulation of fluids on a micrometer scale
- Small Reynolds number: viscous forces, laminar flow
- Capillary flow, autonomous flow
- Advantages of size: portability, low consumption (sample, reagents)
- Lab-on-a-chip: miniature version of a complete laboratory
- Organ-on-a-chip: cell cultures, tissues on a microchip
- Generating chemical gradients
- Cell-trapping and behaviour monitoring
- Measurements with bacteria and antibiotics

Goal: chemical gradient generation, cell-trapping, electrode integration, impedance spectroscopy based measurements, rapid antibiotic resistance measurements



# Lab-on-a-chip

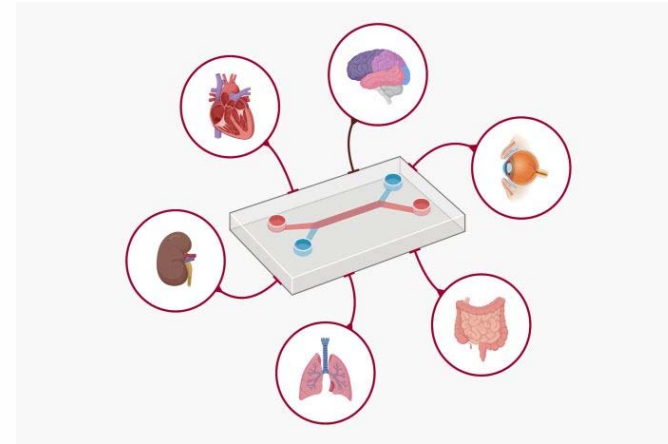


Polimer alapú mikrofluidikai eszközök technológiája, Holczer Eszter

## Advantages:

- Low consumption, reduced waste
- Point-of-care
- Fast, precise, controllable
- Low cost, disposable

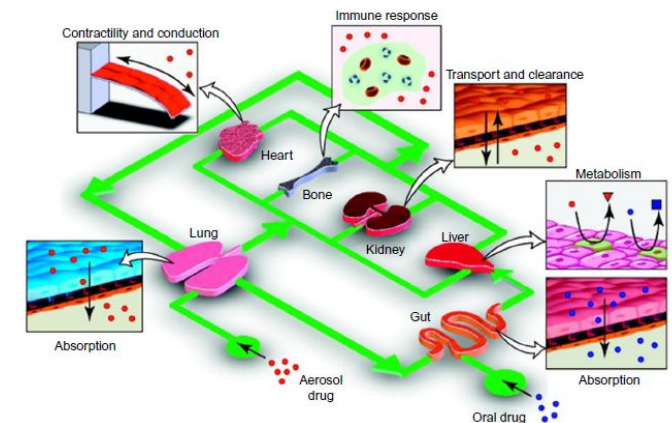
# Organ-on-a-chip



<https://www.ufluidix.com/microfluidics-applications/organ-on-a-chip/>

## Advantages:

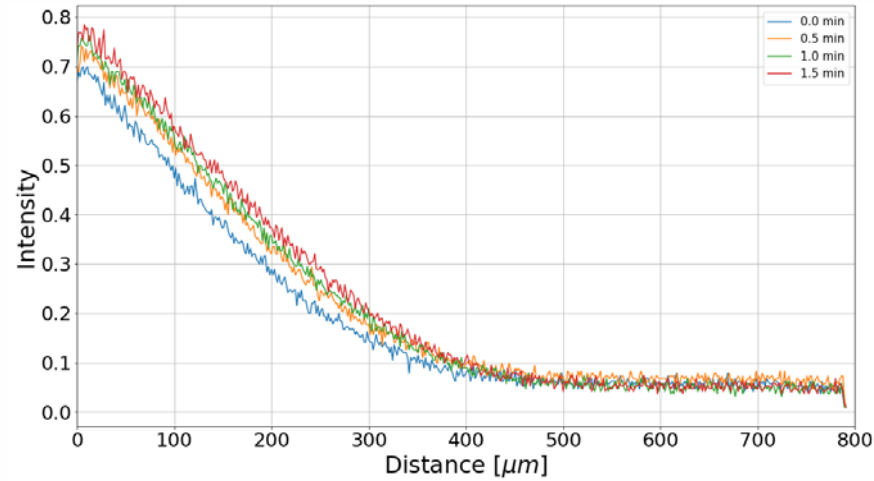
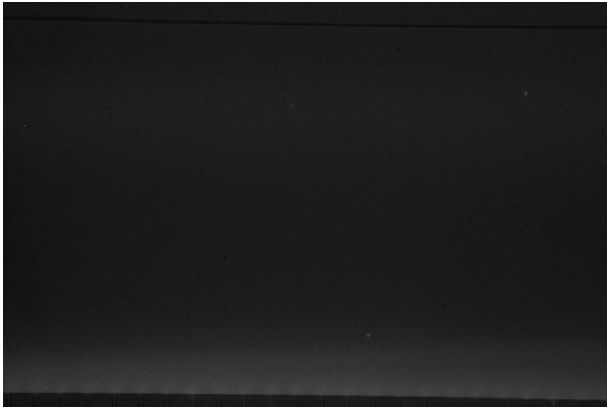
- Reduce or replace animal testing
- Drug development and tests
- Cancer research



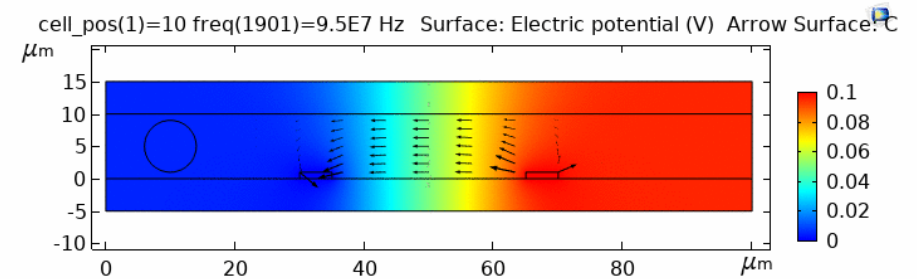
Lab-on-a-chip technology and microfluidics: Antonio Francesco, Vanessa F. Cardoso, Senentxu Lanceros Mendez, 2019

# Results in previous semesters

## Protein Diffusion: IgG



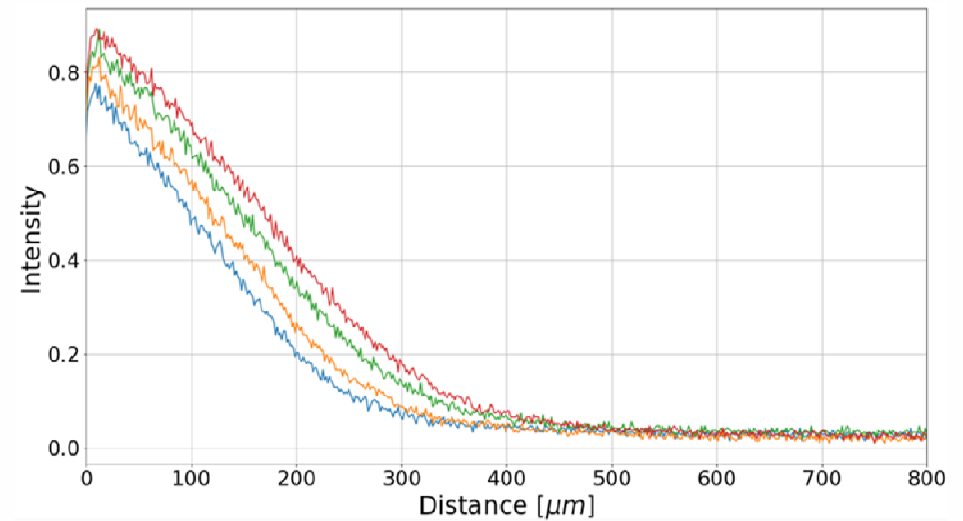
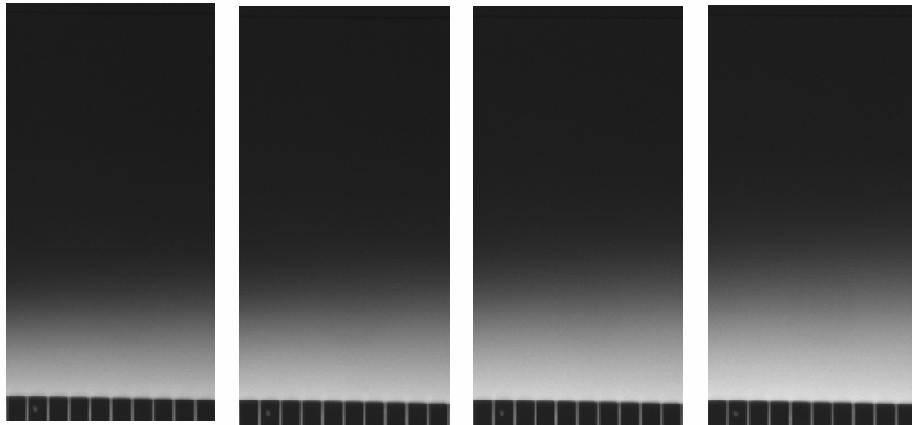
## Cell trapping: Yeast, Fluorescent Nanoparticles



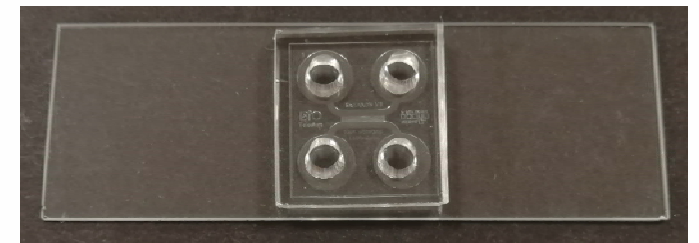
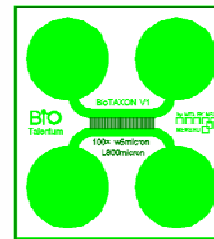
# Results in current semesters

## Protein Diffusion: BSA, IgG, Rh B

- Publication: Manuscript waiting for revision
- Python evaluation program, error function fitting



Material	D of measurement [ $\mu\text{m}^2/\text{s}$ ]	D in literature [ $\mu\text{m}^2/\text{s}$ ]
BSA	$64.24 \pm 0.63$	60.7, 63.8, 72
IgG	$38.95 \pm 0.29$	38, 40
Rh B	$372.74 \pm 3.32$	360, 420, 427



- Publication: Manuscript waiting for revision

# Publications

- Manuscript of protein diffusion coefficient measurements

# Conferences

- Mátrafüred 2022 – International Meeting on Chemical Sensors – Poster (June 12-17)
  - *Lilia Bató , Péter Fürjes, **Individual cell trapping and viability testing in microfluidic device**, Mátrafüred 2022 – International Meeting on Chemical Sensors, Visegrád, Hungary, 2022*
- Rotterdam – Lab-on-a-Chip Microfluidics Europe – Poster (June 21-22)
  - *Lilia Bató, Péter Fürjes, **A fluorescent detection method to measure the diffusion coefficients of proteins in a free-diffusion based microfluidic system**, Lab-on-a-Chip Microfluidics Europe 2022 Conference, Rotterdam, The Netherlands, 2022*

# Courses completed:

- Semiconductor technologies
- Semiconductor devices

# Future plans

## Research

- Electrode integration
- Impedance spectroscopy measurements on trapped yeast cells
- Rapid antibiotic resistance measurements (E. Coli)

## Publication

- Protein diffusion article

