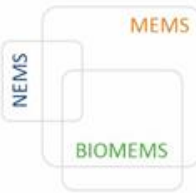


Doctoral Conference



# Microfluidic Systems For Drug Analytical Applications

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# Introduction

## Cancer

- 10 million deaths per year [1]
- 19 million newly diagnosed cancer patients [1]
- The leading cause of death worldwide
- The 5-year survival of the most common cancers is still low

## Chemotherapy (CT)

- Widely used to treat malignancies
- 60%-of all cancer patients ~11 million people were treated
- CT protocols are established on a **“one size fits all”** basis



Ignore inter-patient differences in drug pharmacokinetic



Leading to improper dosing  
**Drug resistance and unwanted side effects**



**Therapeutic Drug Monitoring (TDM) is the key to improve and personalize CT**



- The lack of an affordable point-of-care (POC) method
- Mass Spectrometry is the „golden standard”
- No TDM- capable device

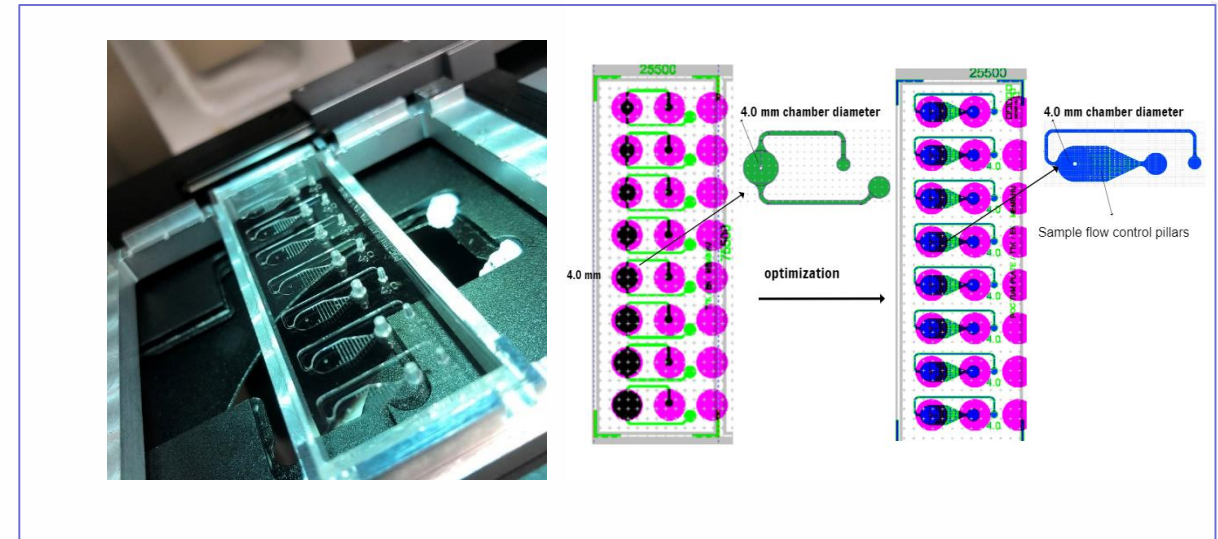


**TDM is a non-existing strategy in clinical oncology**

# Results in the previous semester

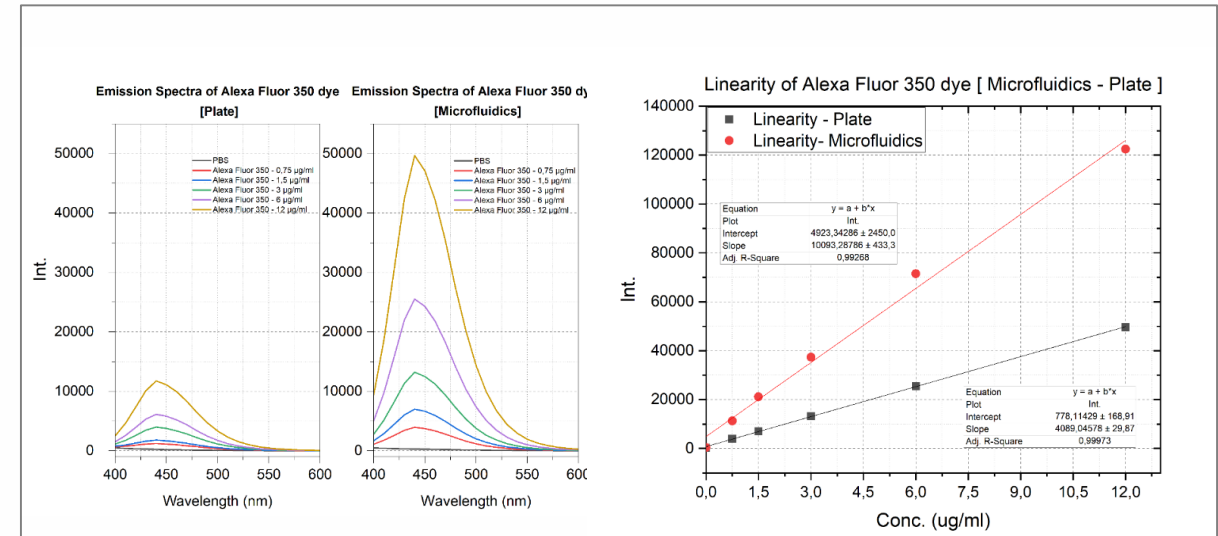
## 1. Microfluidic – device development

- ✓ A Plate Reader-compatible microfluidic chip was designed and manufactured
- ✓ The geometric parameters of the microfluidic structure were optimized
- ✓ The microfluidic chip is suitable for the detection of microvolume samples
- ✓ Suitable for measuring the concentration of molecules having fluorescent properties



## 2. Fluorescent method development

- ✓ The spectral fluorescent properties of Alexa Fluor 350 dye were screened
- ✓ The signal intensity and linearity were tested
- ✓ Advanced sensitivity and excellent linearity were achieved by using a microfluidic cuvette



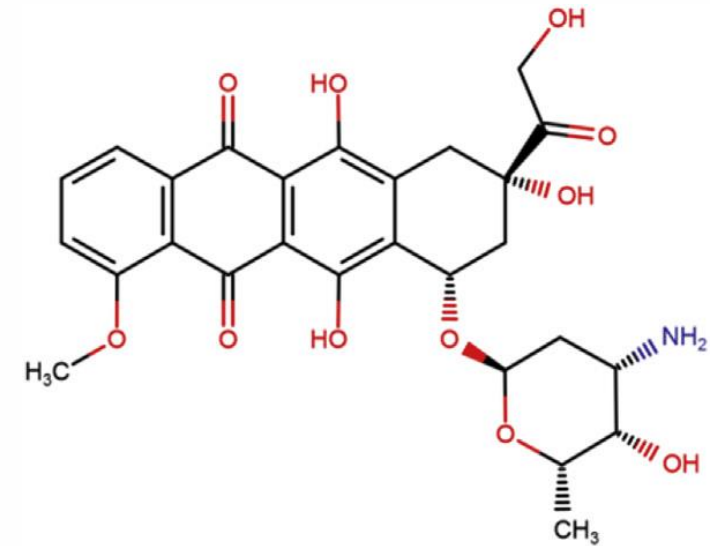
# Detection methodology for Anthracyclines

## Anthracyclines

- Fluorescent emission at 600 nm - detection in biological samples [2]
- Widely used group of CT- childhood cancer/breast cancer/lymphomas

## Method development

- The spectral properties of anthracyclines were screened by using Tecan Spark Plate Reader both in a conventional plate and a designed microfluidic chip in the UV-VIS range (200-800 nm)
- Absorption and fluorescence emission spectra were determined for detailed spectral properties
- The effect of using different solvents (PBS, FBS) on the signal intensity was investigated
- The effect of volume reduction on signal intensity was tested in a microfluidic environment
- Signal intensity and linearity were tested in a microfluidic environment

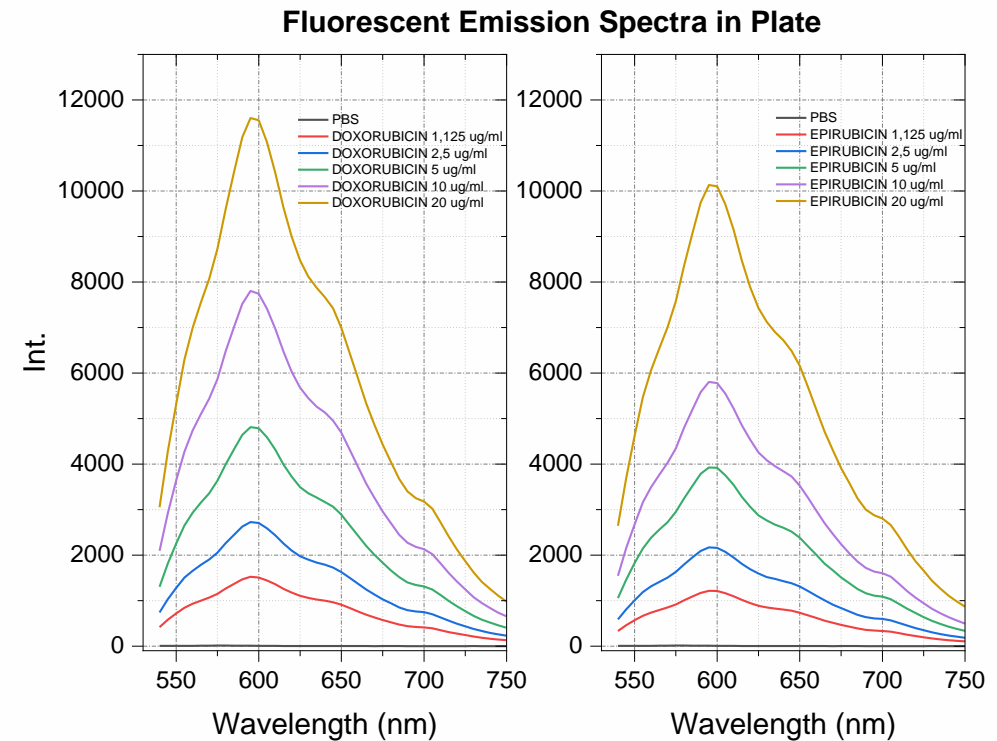
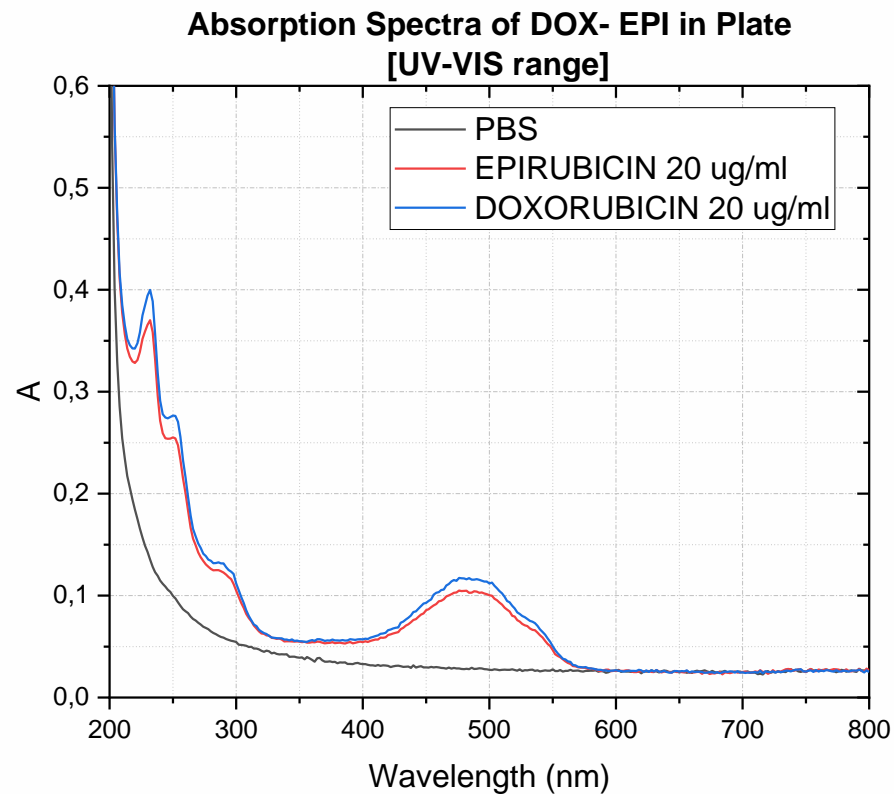


## Structure of Doxorubicin

<http://www.chemspider.com/ChemicalStructure.29400.html>

# Results in a 96-well plate

- The absorption and fluorescent emission spectra of Epirubicin and Doxorubicin were screened in a conventional 96-well plate [in PBS buffer solution]
- The fluorescent emission maximum of the measured drugs was around 590-600 nm
- Anthracyclines are appropriate for further measurement in a microfluidic environment



# Publications

1. Bereczki Dóra, András Füredi, and Péter Fürjes "**Plate reader compatible microfluidic chambers for fluorescent spectroscopy**," Mátrafüred – International Meeting on Chemical Sensors, June 12-17, 2022, Visegrád, Hungary
2. Bereczki Dóra, András Füredi, and Péter Fürjes "**Plate reader compatible microfluidic cuvette for UV-excited fluorescent spectroscopy**," Lab-on-a-Chip and Microfluidics Europe, June 21-22, 2022, Rotterdam, The Netherlands

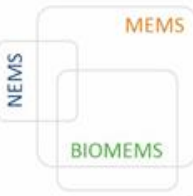
# Subjects

1. **Chemical sensors:** methods and applications-EC methods applied on sensors (Abdul Ibdewi Shaban)
2. **Selected chapters of material testing methods I.:** FTIR, HPLC/MS (Erzsébet Takács), SEM, STM, AFM (Judit Telegdi)

# References

(1) WHO Cancer Today- <https://gco.iarc.fr/today/>

(2) N. S. H. Motlagh, P. Parvin, F. Ghasemi, and F. Atyabi, "Fluorescence properties of several chemotherapy drugs: doxorubicin, paclitaxel, and bleomycin," *Biomedical Optics Express*, vol. 7, no. 6, Art. no. 6, May 2016, doi: 10.1364/BOE.7.002400.





# Thanks for your attention!

