

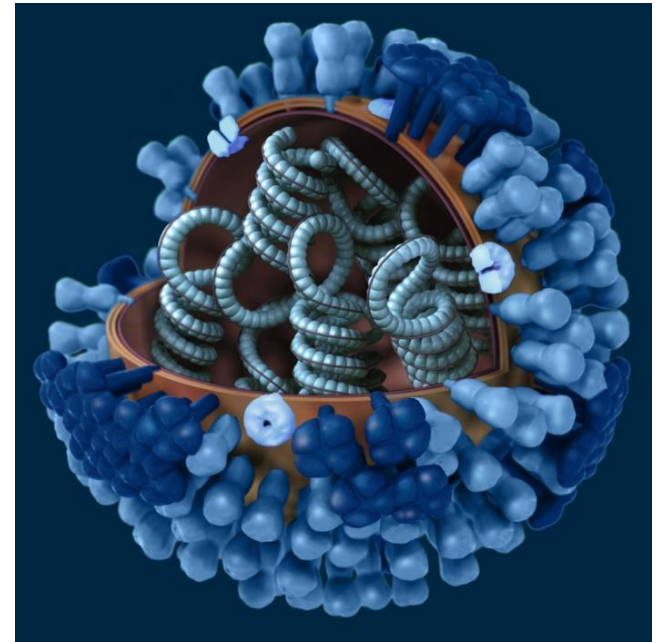
Name: **3D CHIP AS A TOOL FOR ISOLATION AND DETECTION
OF INFLUENZA VACCINE HEMAGGLUTININ**

Author: MVDr. Ludmila Krejčová

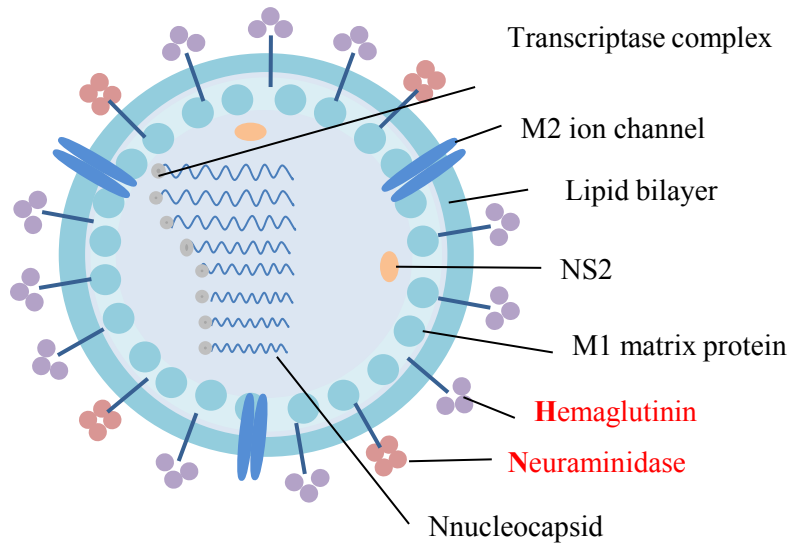
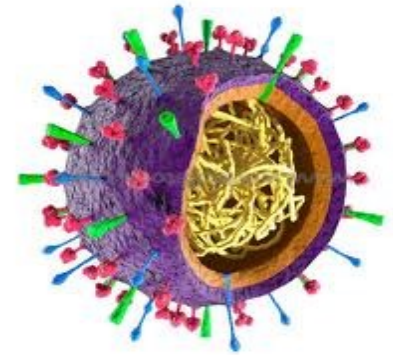
Date: 15.11.2013

CONTENT

- Basic about influenza
- History and pandemic potential
- Principle of the method
- 3D technology and chip fabrication
- Results
- Summary and prospects for the future



INFLUENZA?



- An infectious respiratory disease of birds and mammals
- Caused by ss RNA viruses, family Orthomyxoviridae
- Influenza A, B and C (structure, host range and virulence)

Just ordinary seasonal disease?

Is it true?

Is INFLUENZA dangerous?

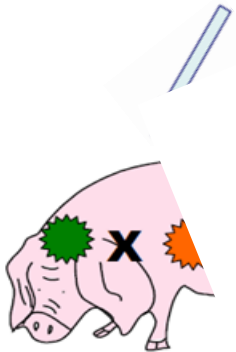
seasonal epidemic



rapid and well-timed diagnostics is required

and

reassortment origin influenza



dangerous lethal pandemic

1918

Spanish flu

It killed more people in the **25 weeks**, whereas HIV/AIDS in **25 years**.

50 milion victims

End of story?

NO!



Spain flu



Asian flu

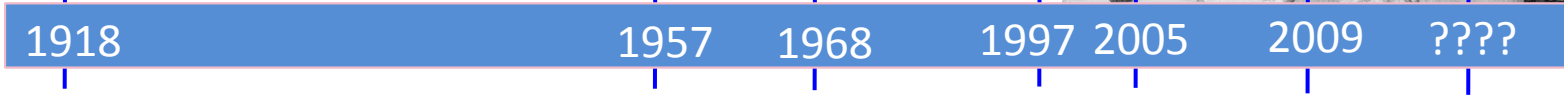
Honkong flu

Avian flu

Avian flu (HPAI)

Swine flu

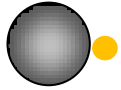
NEXT?



I'm INFLUENZA. Nice to meet you.

Princip of isolation

Streptavidin modified MPs



+

Biotinylated glycan

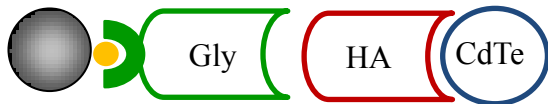



Hemagglutinin

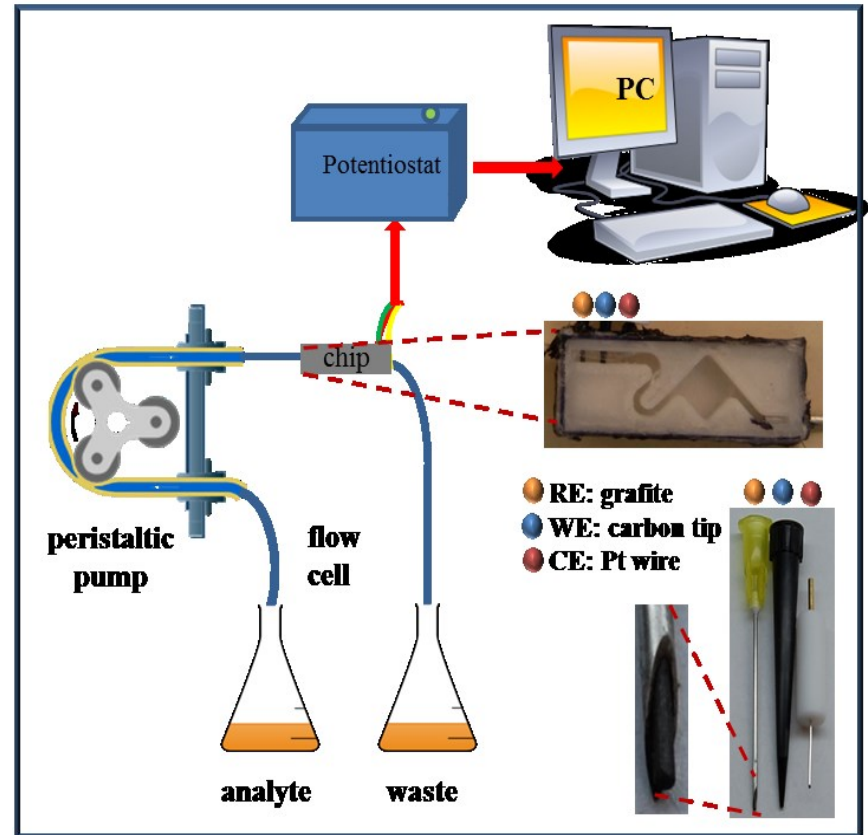
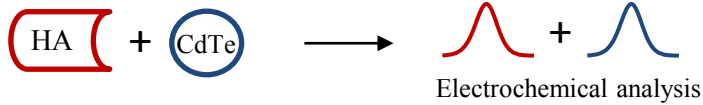


+

Quantum dots (CdTe)

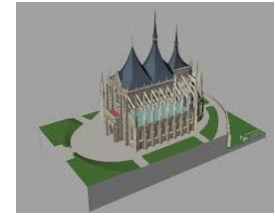
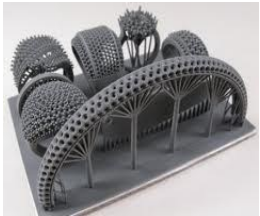


sonication 



3D technology

- Charles Hull, 1986, stereolithography
- 90. first 3D printer
- Since 2003, the development progression
- Almost everything can be produced by 3D technology (industry, furniture, sport, automotive...food)

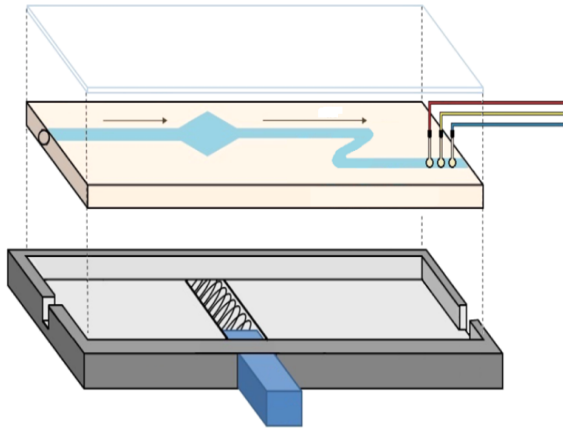


How does it work?

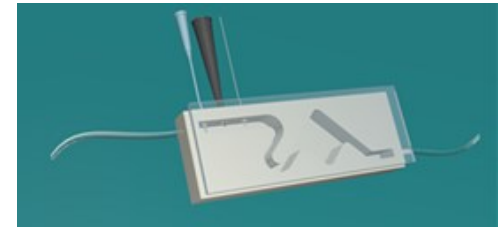
- Thermoplastic fiber (1.75 mm) is heated to a temperature of 220 ° C and applied by means of nozzles (0.2 to 0.5 mm).
- Nozzle movemes in X, Y and Z (accuracy up to 0.08 mm).
- The individual layers are applied cascaded to the pad.



3D chip design and optimization of procedure parameters



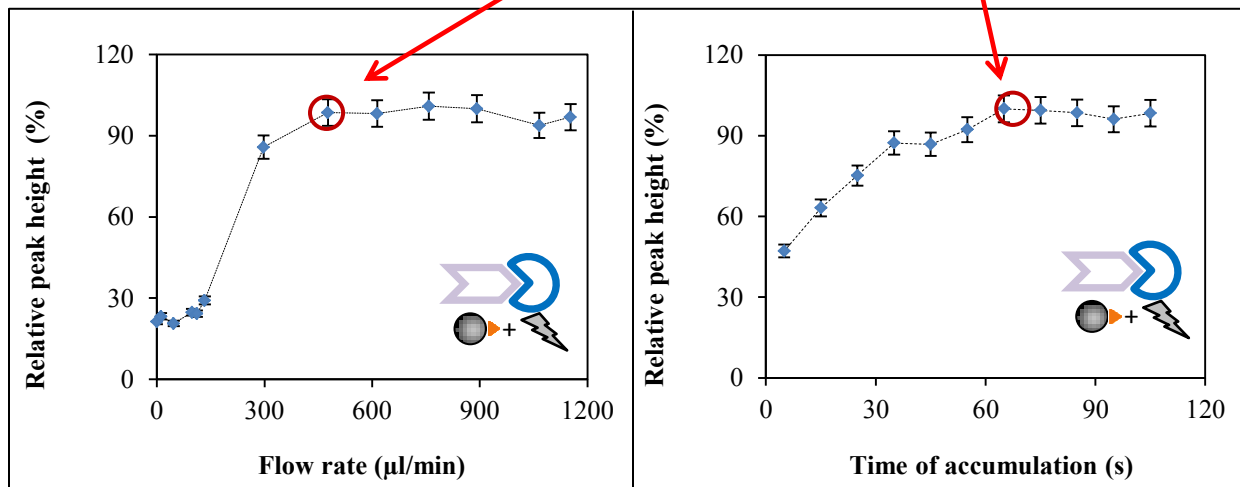
- Size: 150 x 400 x 50 mm
- Cell volume 500 μ l
- Single use
- Environmentally friendly



PLA bio-degradable polymer
produced from lactic acid, maize fermentation

Optimized parameters: flow rate, time of accumulation

Optimal: 480 μ l/min (flow rate), 65s (time of accumulation)



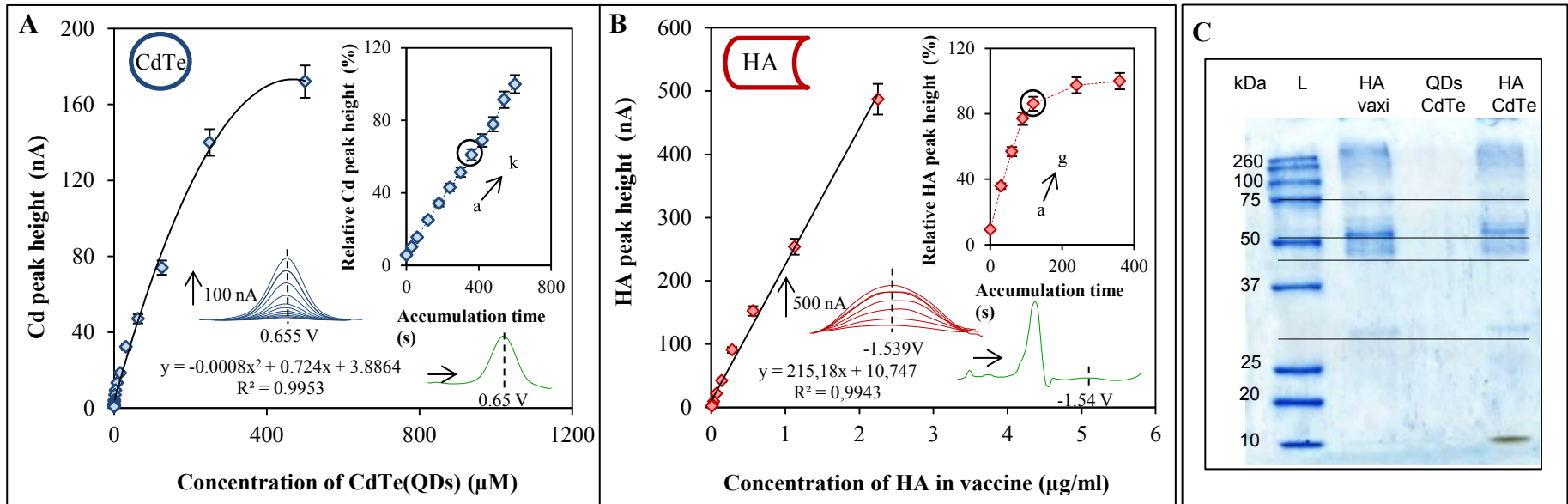
Electrochemical and SDS PAGE analysis

two different voltammetry methods:

cadmium (Cd peak) was measured by differential pulse voltammetry (DPV)

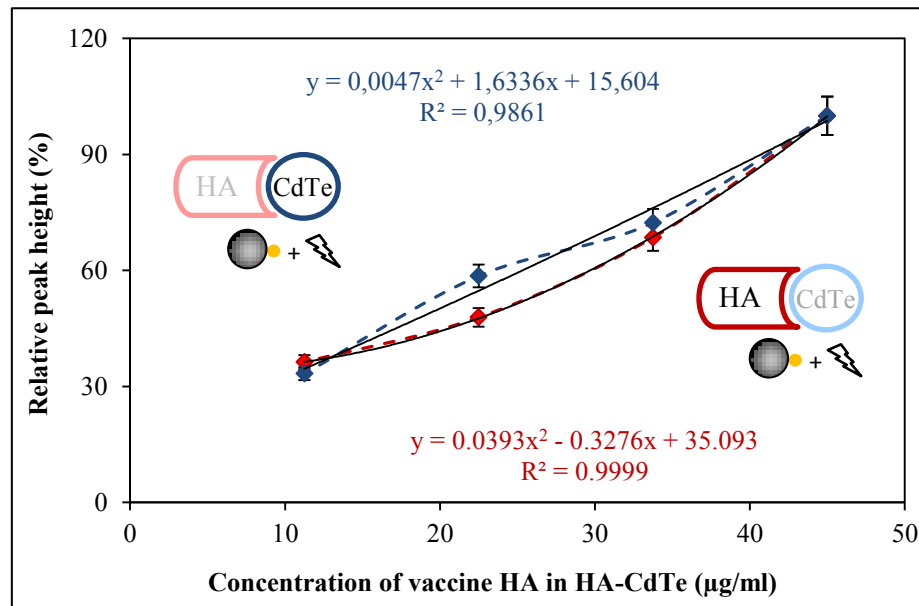
hemagglutinin (HA peak) was measured by adsorptive transfer technique of DPV (AdT DPV)

HA, CdTe, HA-CdTe complex was characterized also by gel electrophoresis



Influence of HA concentration on HA/Cd peak

- Four different concentration of HA(in HA-CdTe complex) were applied
 - HA and Cd peak was detected
- Dependences of yeald of method on applied concentration of HA-CdTe complex was established



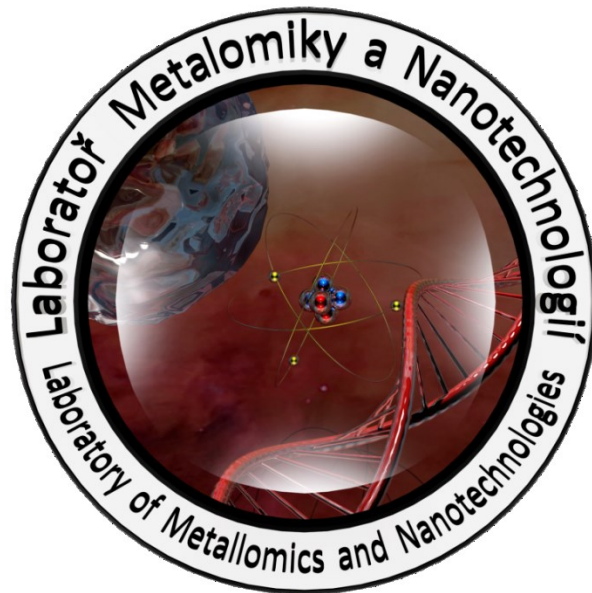
Summary

It was designed and developed new toll for influeza hemagglutinin isolation and detection.

Krejcová, L., et al., *3D printed chip for electrochemical detection of influenza virus labelled with CdS quantum dots*.
Biosens. Bioelectron., 2013. in press. (Q1)

Prospects for the future?

Method is applicable for detection of other pathogens, cancer or hereditary diseases.



Acknowledgements

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Thank you for your attention.

Reg.č.projektu: CZ.1.07/2.4.00/31.0023

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