
  
INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

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

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Reg. č. projektu: CZ.1.07/2.4.00/31.0023  
Název projektu: Partnerská síť centra excelentního bionanotechnologického výzkumu 

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**CONTENT**

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



[http://en.wikipedia.org/wiki/Image:EM\\_of\\_influenza\\_virus.jpg](http://en.wikipedia.org/wiki/Image:EM_of_influenza_virus.jpg)

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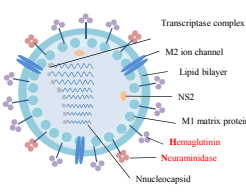
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**INFLUENZA?**



- 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?

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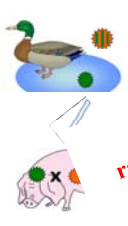
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### Is INFLUENZA dangerous?



seasonal influenza

and

reassortment origin influenza

dangerous lethal pandemic

rapid and well-timed diagnostics is required

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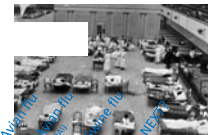
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### 1918 Spanish flu

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

End of story?  
**NO!**

1918 1957 1968 1997 2005 2009 ????

I'm INFLUENZA. Nice to meet you.

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### Princip of isolation

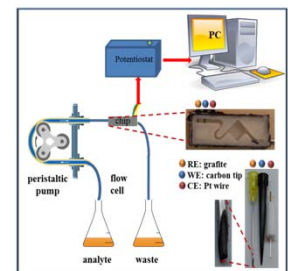
Streptavidin modified MPs + Biotinylated glycan

Hemagglutinin (HA) + Quantum dots (CdTe)

Gly + HA + CdTe

sonication

HA + CdTe → Electrochemical analysis



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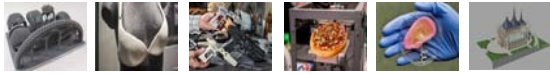
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### 3D technology

- 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 moves in X, Y and Z (accuracy up to 0.08 mm).
- The individual layers are applied cascaded to the pad.

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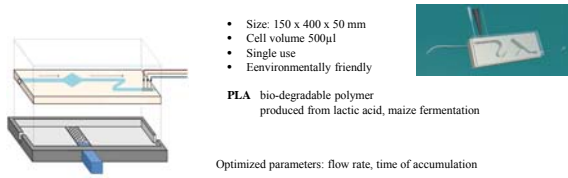
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### 3D chip design and optimization of procedure parameters



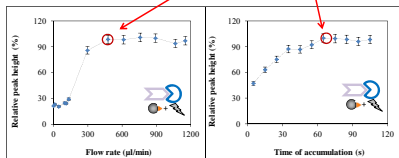
- Size: 150 x 400 x 50 mm
- Cell volume 500µl
- Single use
- Environmentally friendly



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

Optimized parameters: flow rate, time of accumulation

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



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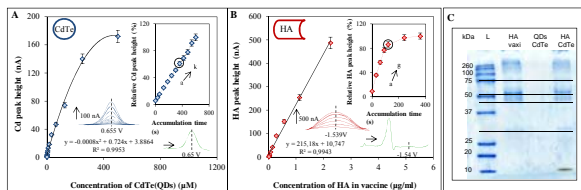
### Electrochemical and SDS PAGE analysis

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



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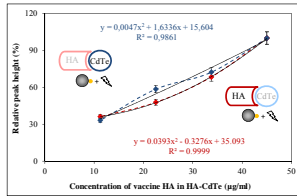
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**Influence of HA concentration on HA/Cd peak**

- 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




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**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.

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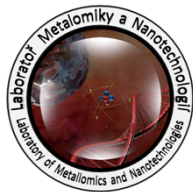
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Thank you for your attention.

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