Swine diseases field diagnostics toolbox

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1. 2. CyRIC 3. ΓΕΩΠΟΝΙΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ AGRICULTURAL UNIVERSITY OF ATHENS 4. KON TOR 46 5. Consiglio Nazionale delle Ricerche 6. ISS BiOSense Innovation in Optical Biosensors 7. LUMENSIA sensors 8. UNIVERSITAT POLITÈCNICA DE VALÈNCIA 9. PIWet 10. UNIVERSITÀ DEGLI STUDI FIRENZE DISPAA DIPARTIMENTO DI SCIENZE DELLE PRODUZIONI AGROALIMENTARI E DELL'AMBIENTE

BACKGROUND

- Increasing human population needs increasing livestock production and density
- Increased animal density facilitates the spread of infectious agents
- Some OIE-Listed diseases demand immediate control measures
- Point-of-care (POC), mobile, quick and reliable diagnosis is essential

OBJECTIVES

- Our EU H2020 consortium aims to develop of a POC device to detect selected pig viruses:

Targeted viruses	SWINOSTICS samples
✓African swine fever (ASF)	Oral fluid in live animals, blood serum postmortem
✓Porcine reproductive and respiratory syndrome (PRRS)	Oral fluid and blood serum
✓Swine influenza A (SIV)	Oral fluid and nasal swabs
✓Porcine Parvovirus (PPV)	Oral fluid and faeces
✓Porcine Circovirus 2 (PCV2)	Oral fluid and blood serum
✓Classical Swine Fever (CSF)	Oral fluid in live animals, blood serum post mortem

CONCEPTUAL DESIGN

- Advanced, reusable, silicon based Photonic Integrated Circuits depending on antibody-antigen bond (**Figure 1**)
- Commercially available monoclonal antibodies will be used, for reliability and specificity, making the toolbox flexible
- Desired sample processing time and result within 30 minutes

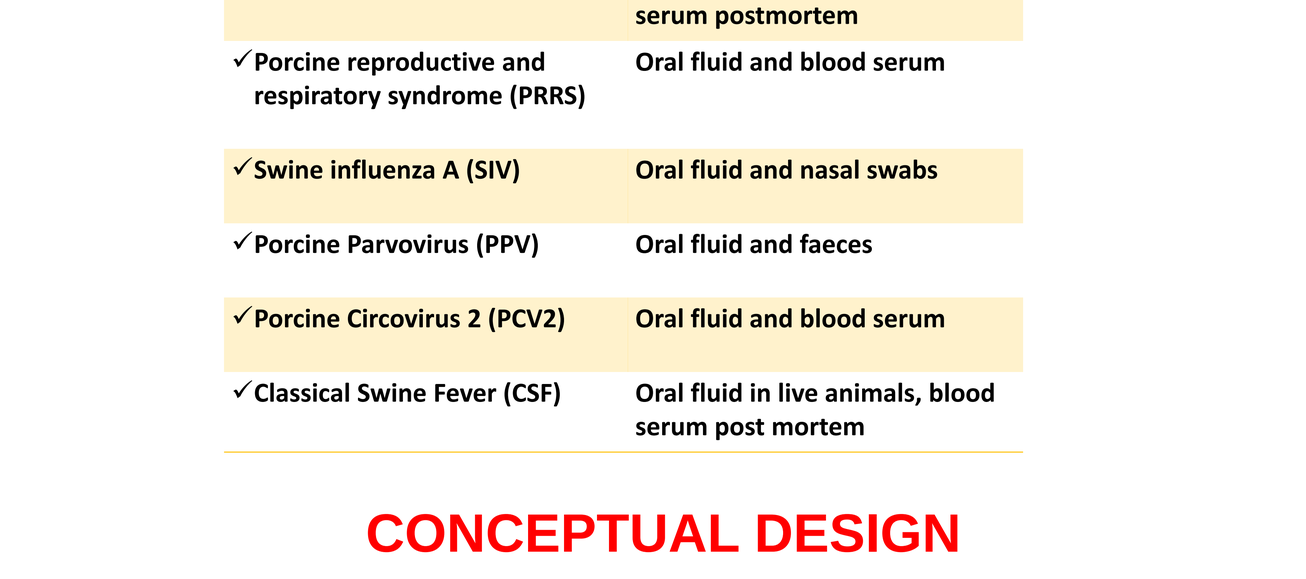

Figure 1. Overall design and architecture scheme

FUNCTIONAL MODULES

1. SWINOSTICS BIOSENSOR

a) **Microfluidic subsystem** – delivery of the sample and buffer fluids to the sensor

b) **Photonic transducer** (**Figure 2, 3a**) – antibodies immobilized on silicon nitride based nano-ring

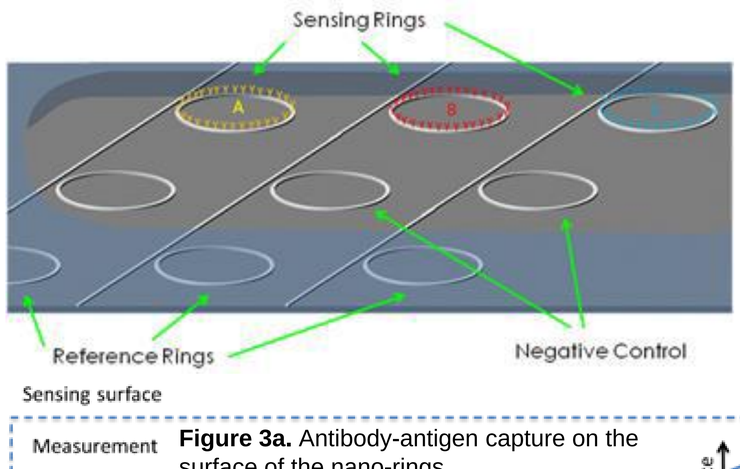

Figure 2. Nano-ring resonators functionalized with the antibodies immobilized on their surface

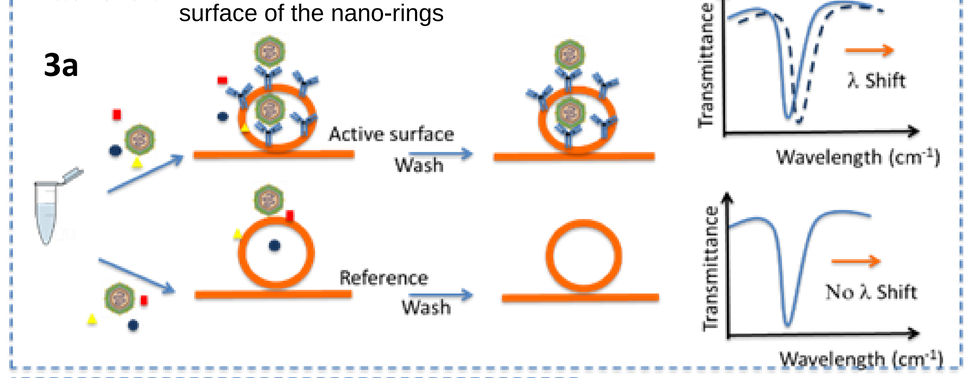

Figure 3a. Antibody-antigen capture on the surface of the nano-rings

Figure 3b. Surface regeneration

c) **Optical analysis module** (**Figure 4**) – positive reaction (antigen capture) changes the refractive index, measured as power and wavelength shift of the laser signal

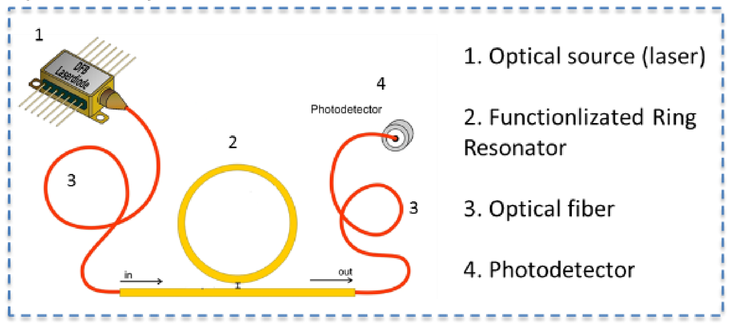

Figure 4. Structure of optical sensing module

2. TEMPERATURE CONDITIONING MODULE

- Providing stable temperature during analysis and storage

3. SURFACE REGENERATION (**Figure 3b**)

- Washing process to remove the antigen from the surface – reusable around 100 times

4. PROCESSING, CONTROL AND COMMUNICATION MODULE

- Communication with tablets, smart phones (Bluetooth, WiFi), cloud based data storage

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LinkedIn: www.linkedin.com/company/18392774
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