

# Nanoparticles-Protein Corona Complex and Particle behaviour

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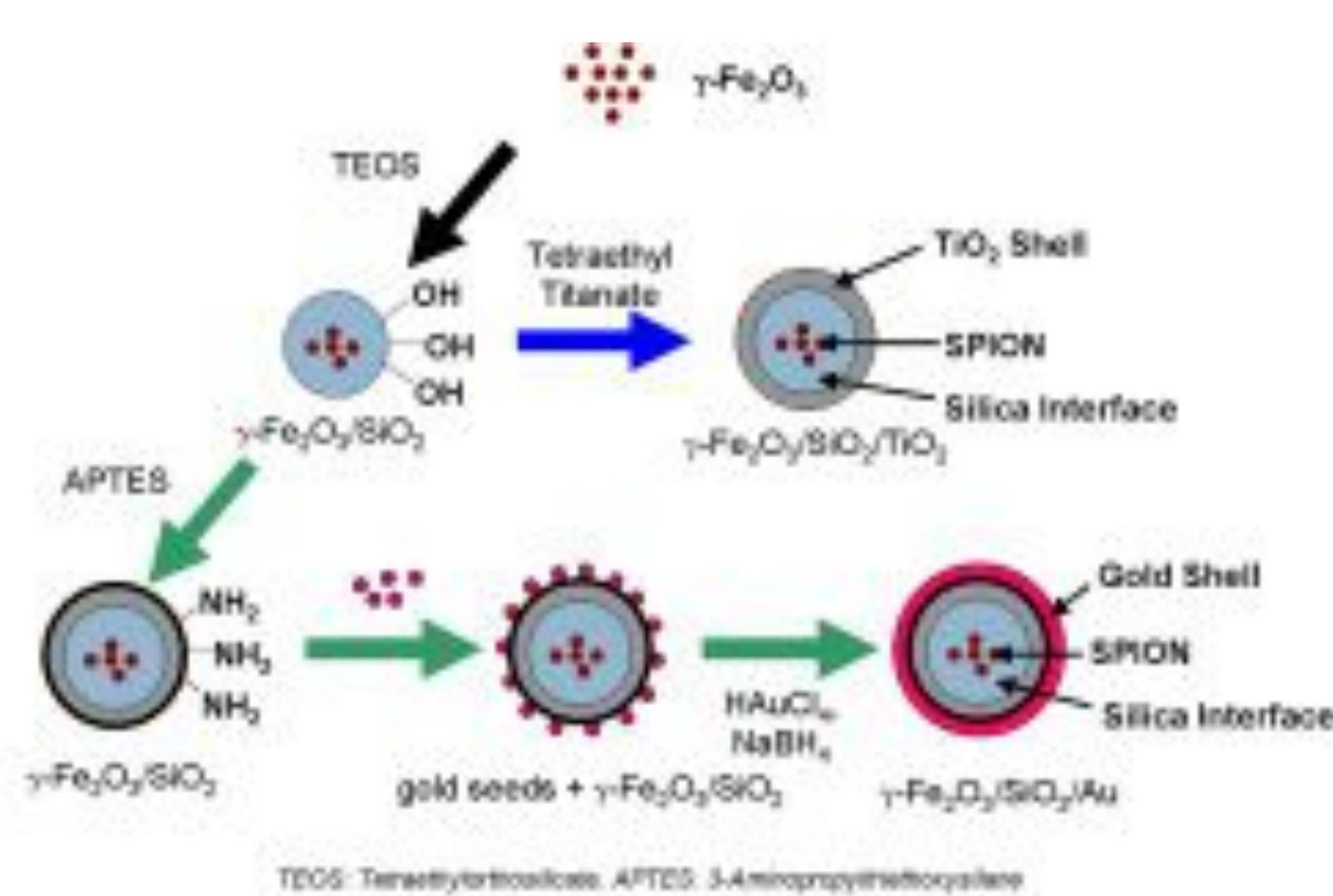
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## Project Goals

Nanoparticle-protein corona complex has one of the most significant effect on the biocompatibility, biodistribution and cellular mechanism, e.g. inter- and intracellular mechanism, cell signaling, interaction partners as well as cellular and molecular function [1]. In this study, we investigated the behavior of superparamagnetic iron oxide nanoparticles (SPIONs) nanoparticles with different surface coatings in biological environment. The SPION magnetic core is an advantage for easy magnetic separation. Determining protein corona on core-shell SPION nanoparticle with different surface coatings would facilitate the understanding of colloidal stability of nanoparticles in biological media and their biological activity *in-vivo*. In addition, these magnetic nanoparticles will be used for protein separation and further diagnostic applications.

## Materials & Methods

### Synthesis of inorganic core-shell nanoparticles based on magnetic core

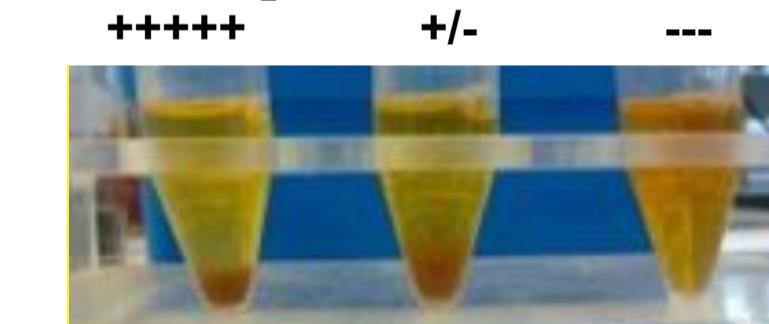


### Nanoparticle incubation with biological fluids

#### Protein corona on different surface charge polymer nanoparticle

- FBS/ particle surface ( $2.8 \text{ ml/m}^2$ )
- Incubation time: 1 h
- Incubation temperature: 37 °C

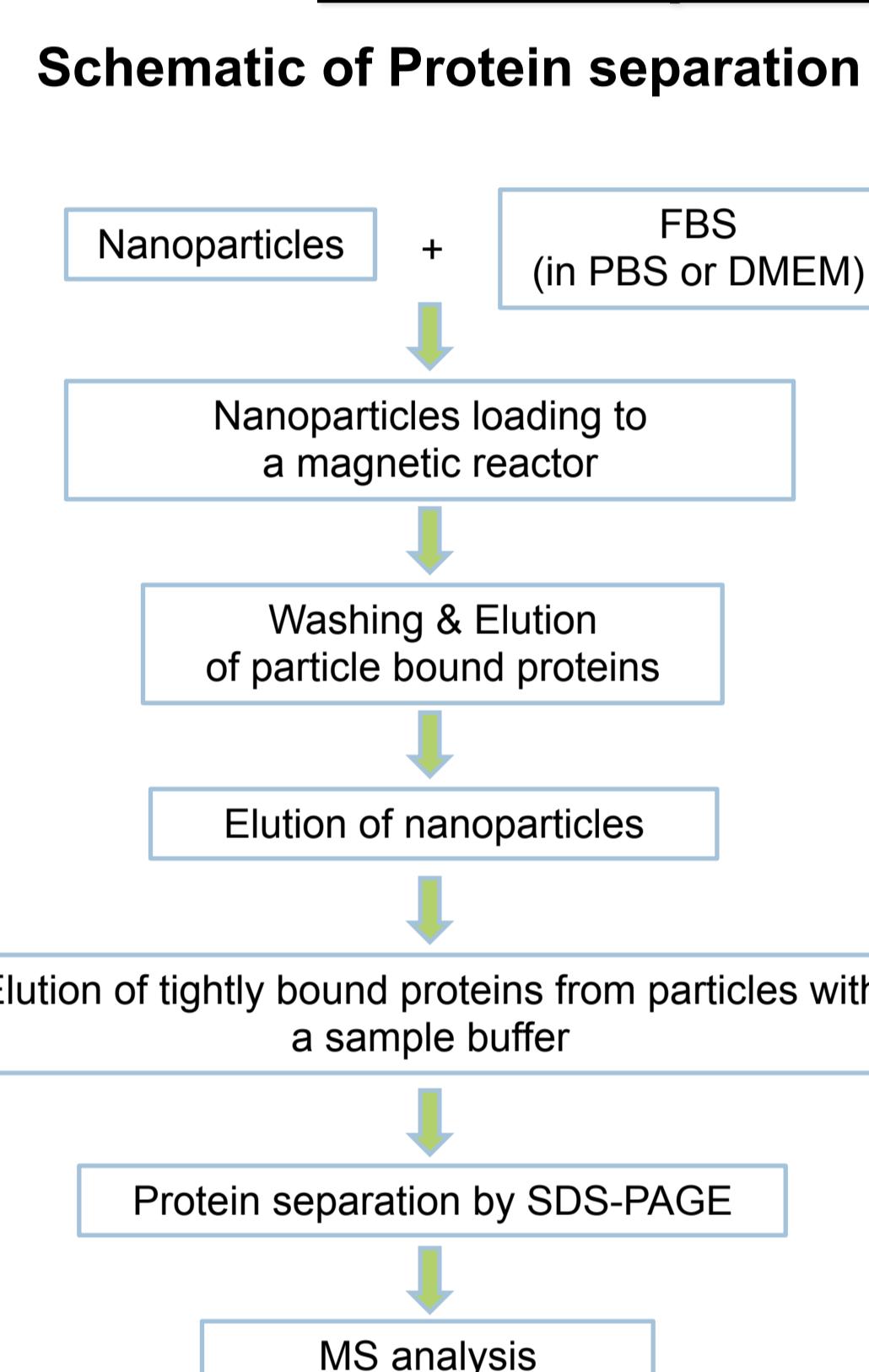
PVA-NH<sub>2</sub>      PVA      PVA-COOH



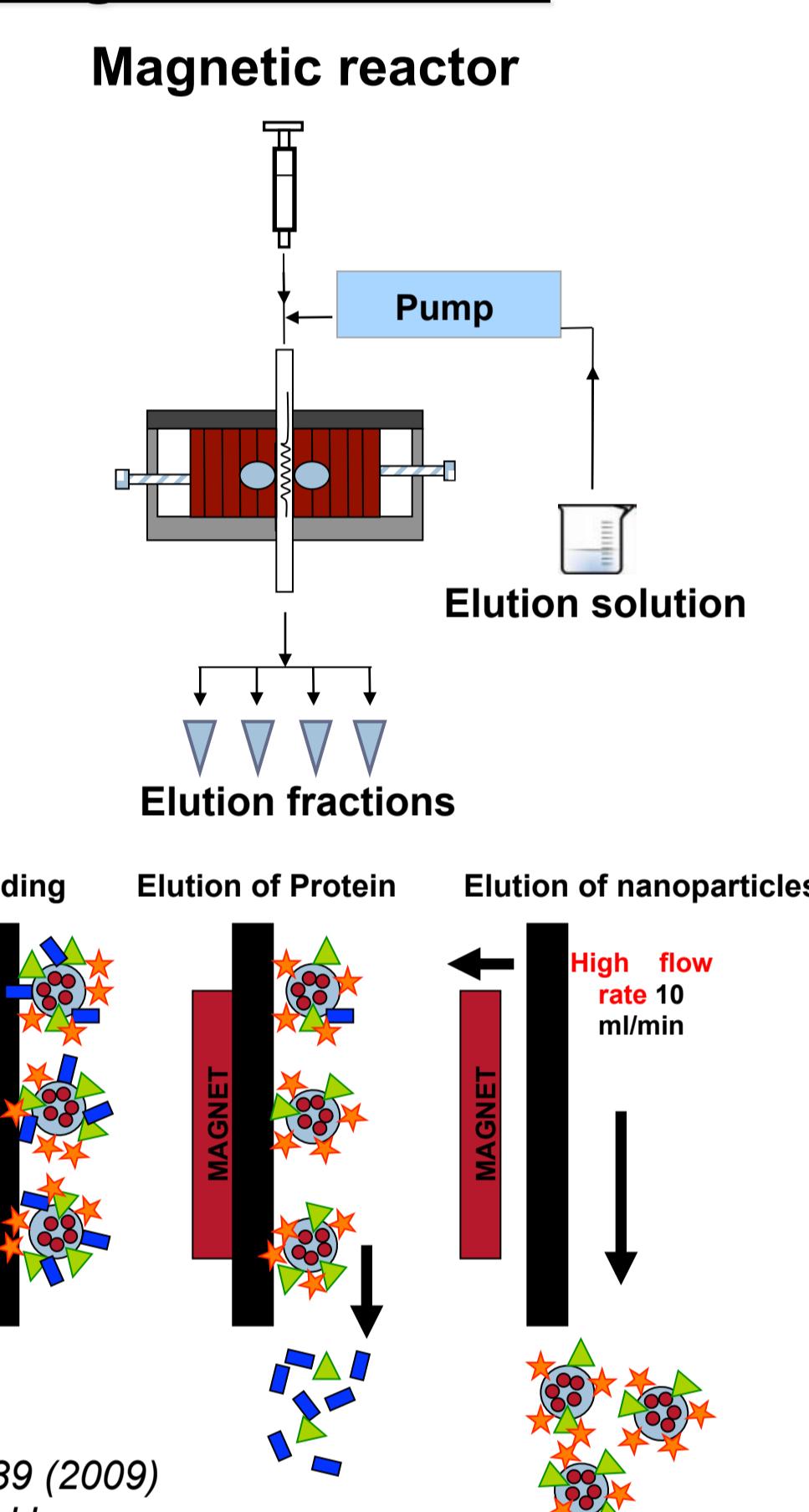
PVA-SPIONs	Hydrodynamic Diameter (nm)	Zeta potential (mV)
PVA-NH <sub>2</sub>	24	43.34 ± 0.91
PVA (neutral)	30	9.28 ± 0.75
PVA-COOH	47	-15.92 ± 0.56

DMEM: Dulbecco's modified Eagle's medium  
PBS: Phosphate buffered saline  
FBS: Fetal bovine serum

### Protein separation by magnetic reactor



Thesis EPFL 4539 (2009)  
Jatuporn Salaklang



## Results

### 1. Protein corona on different surface charged polymer-coated SPIONs

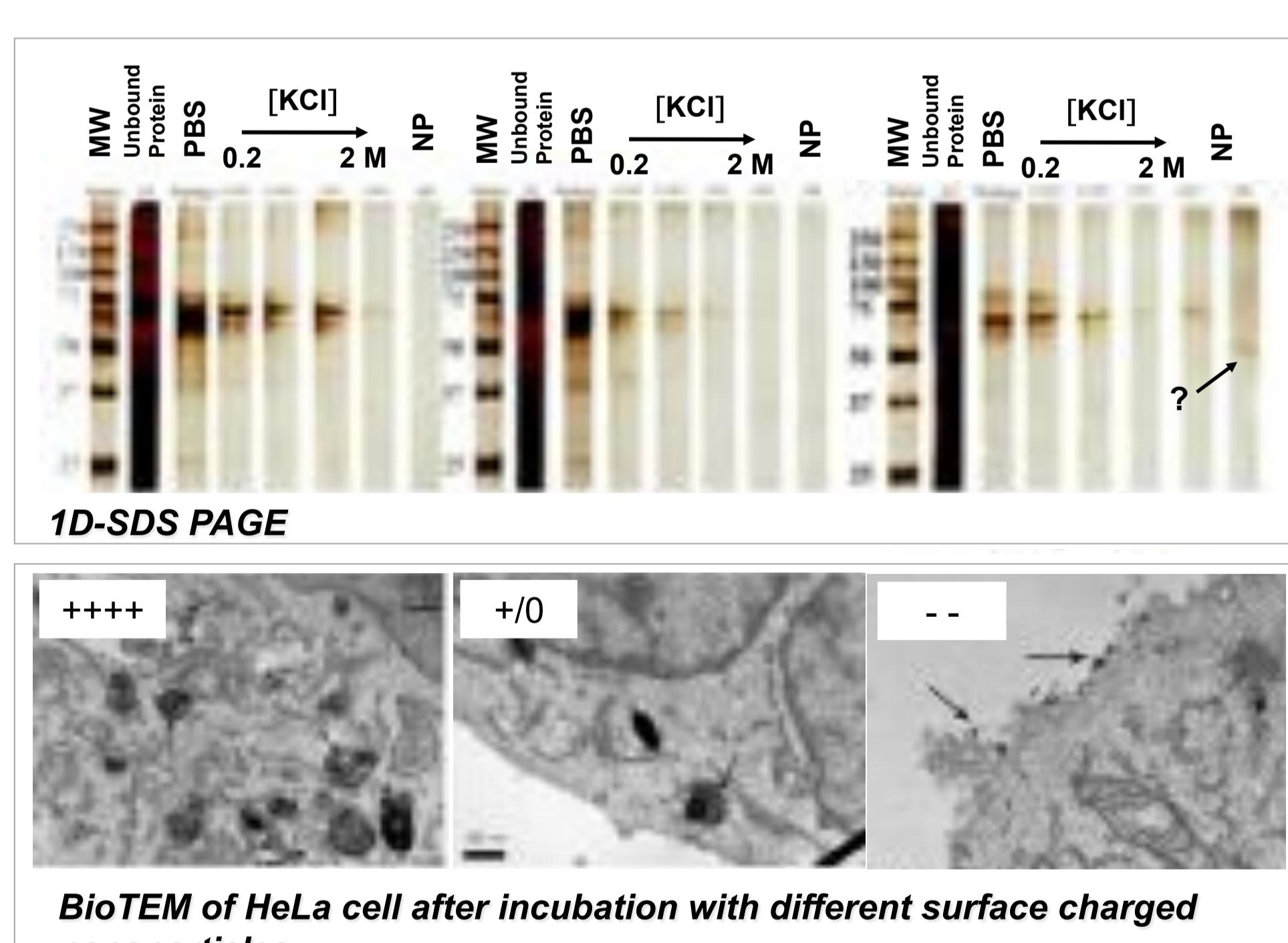
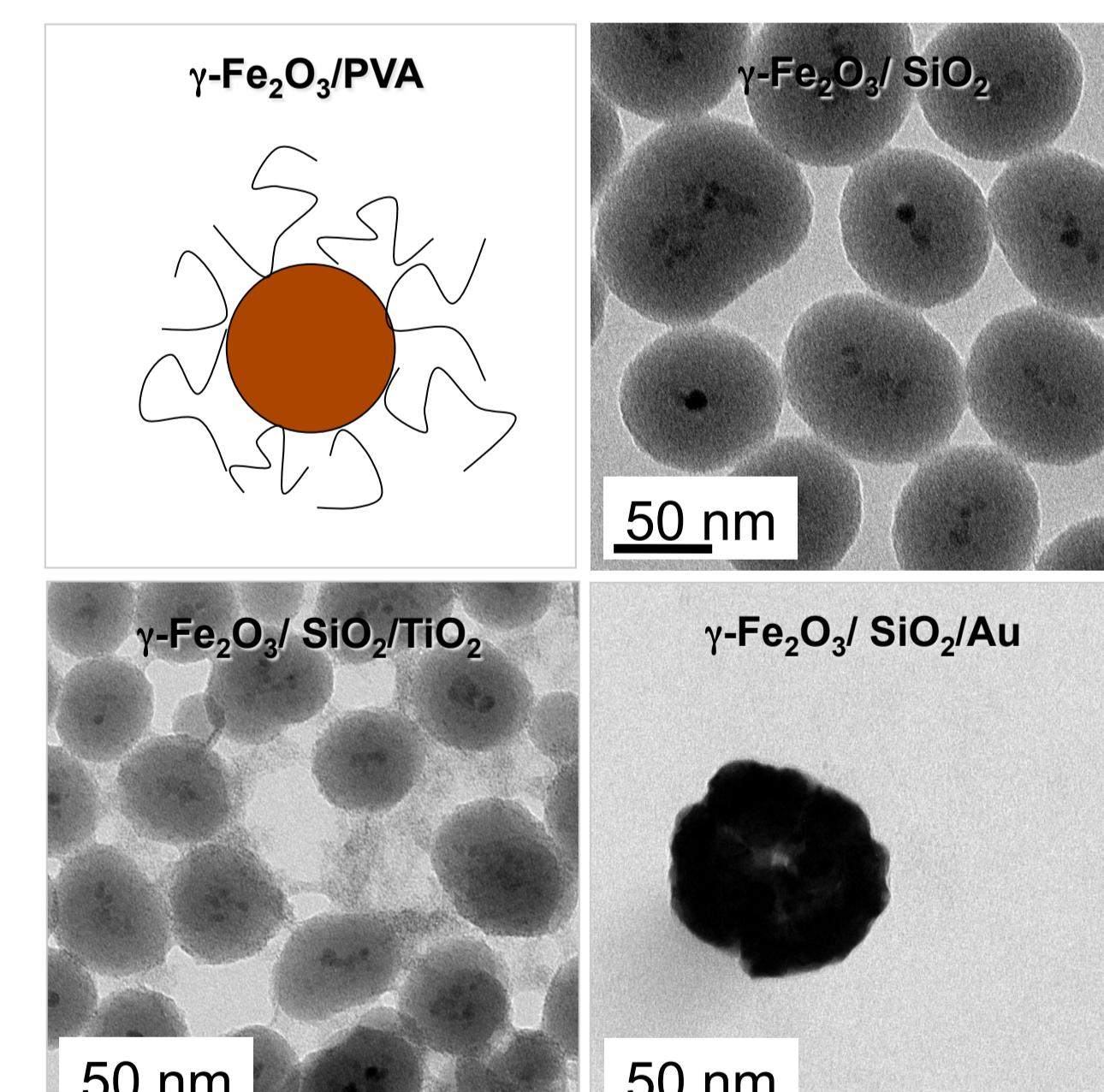


Table 1: MS analysis of protein bound on different surface charged polymer coated nanoparticles

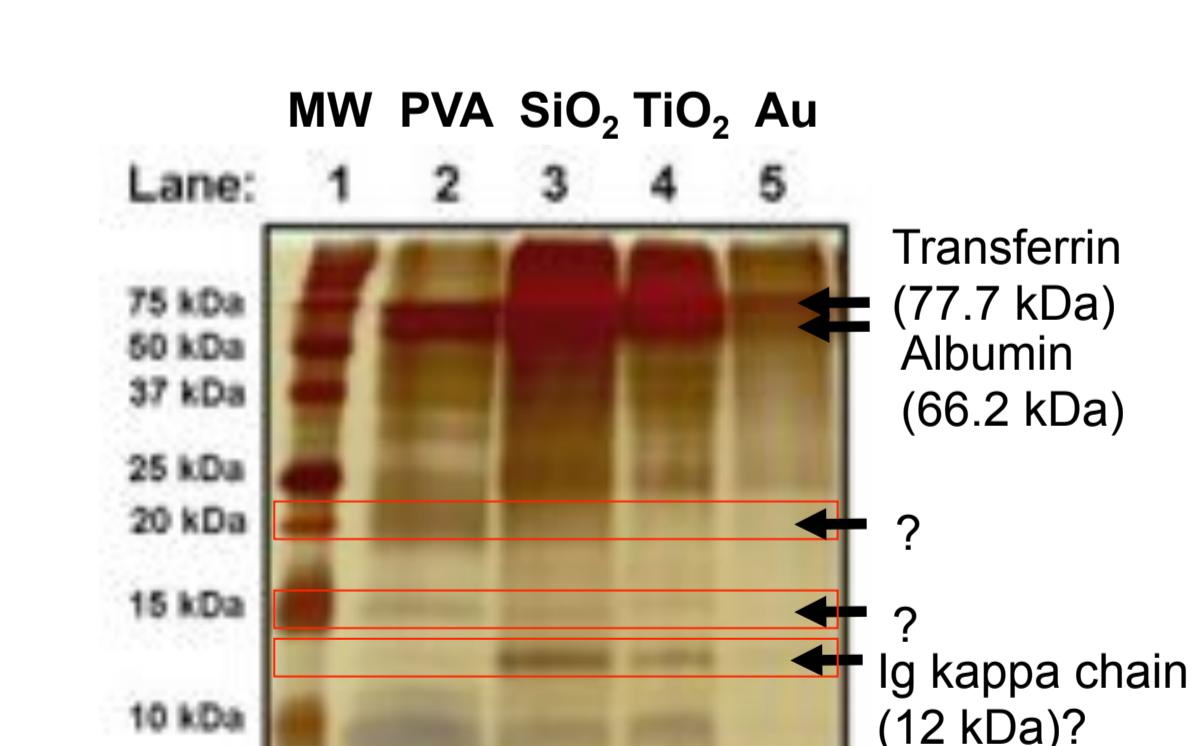
Positive (43.3 mV)	Neutral&Negative
Neutral&Positive	Negative (-15.9 mV)
Neutral (9.2mV)	Negative, Neutral&Positive

NSpC: Normalized spectral count values against Albumin

### 2. Protein corona on different surface materials



Nanoparticle	Diameter (nm)	Zeta potential (mV)
γ-Fe <sub>2</sub> O <sub>3</sub> /PVA	~24	43.3 ± 0.9
γ-Fe <sub>2</sub> O <sub>3</sub> /SiO <sub>2</sub>	83.7±10.9	-35.8±0.5
γ-Fe <sub>2</sub> O <sub>3</sub> /SiO <sub>2</sub> /TiO <sub>2</sub>	85.7±15.7	-30.9±0.6
γ-Fe <sub>2</sub> O <sub>3</sub> /SiO <sub>2</sub> /Au	143.9±18.4	-16.2±0.9



## Conclusions

- Nanoparticle library based on SPIONs was successfully produced.
- Surface properties (e.g. charge, material) determine protein corona and cell internalization.
- Different nanoparticle properties may facilitate specific proteins fishing.

## Outlook

Understanding particles behavior in different biological media (e.g. human serum, urine, synovial fluid) and particle-cell interactions.

Reference: Dawson K.A, et al. 2006. Surface induced changes in protein adsorption and implications for cell-surface response. *Biomaterials* 27: 3096-3108.

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The Swiss National Science Foundation (SNSF: 205321-120161) and European Project FP7 (NanoDiaRA) and for a financial support.

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