# NanoFaceS

# Interaction of metallic nanoparticles with sulfur-containing biomolecules – implications for nano-bio interface


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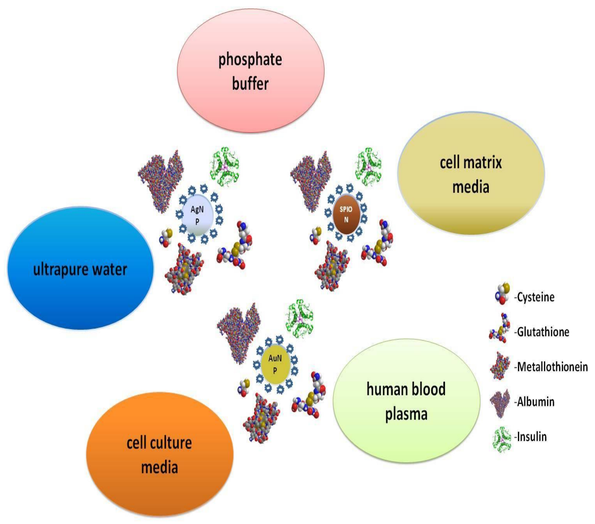
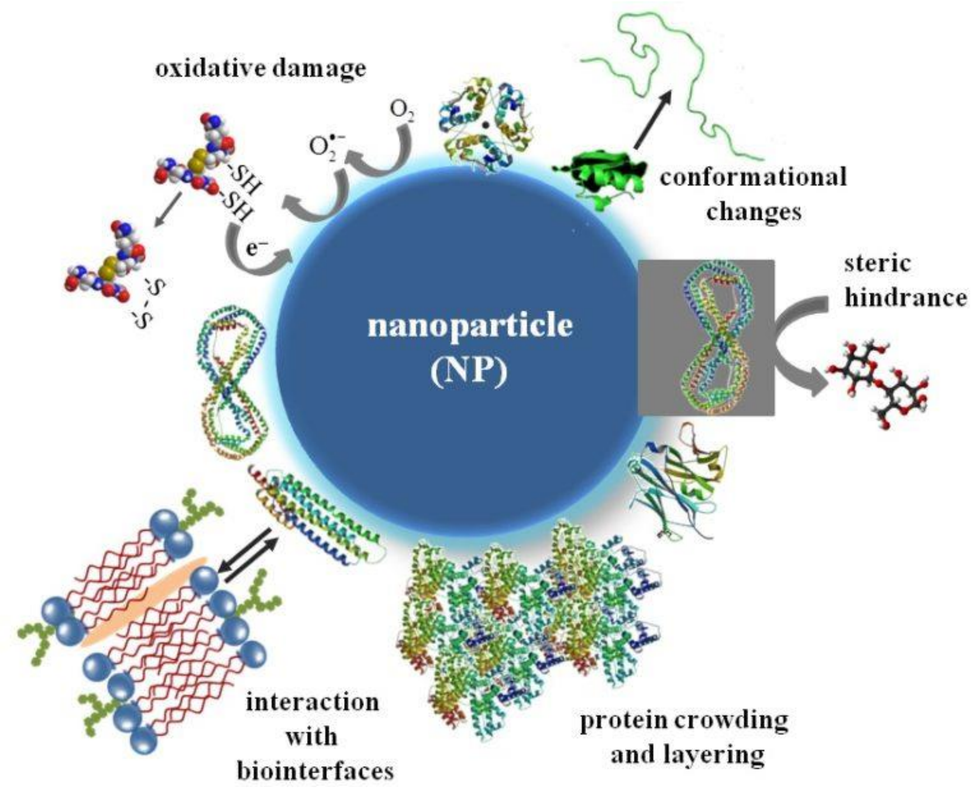
## PROJECT DESCRIPTION

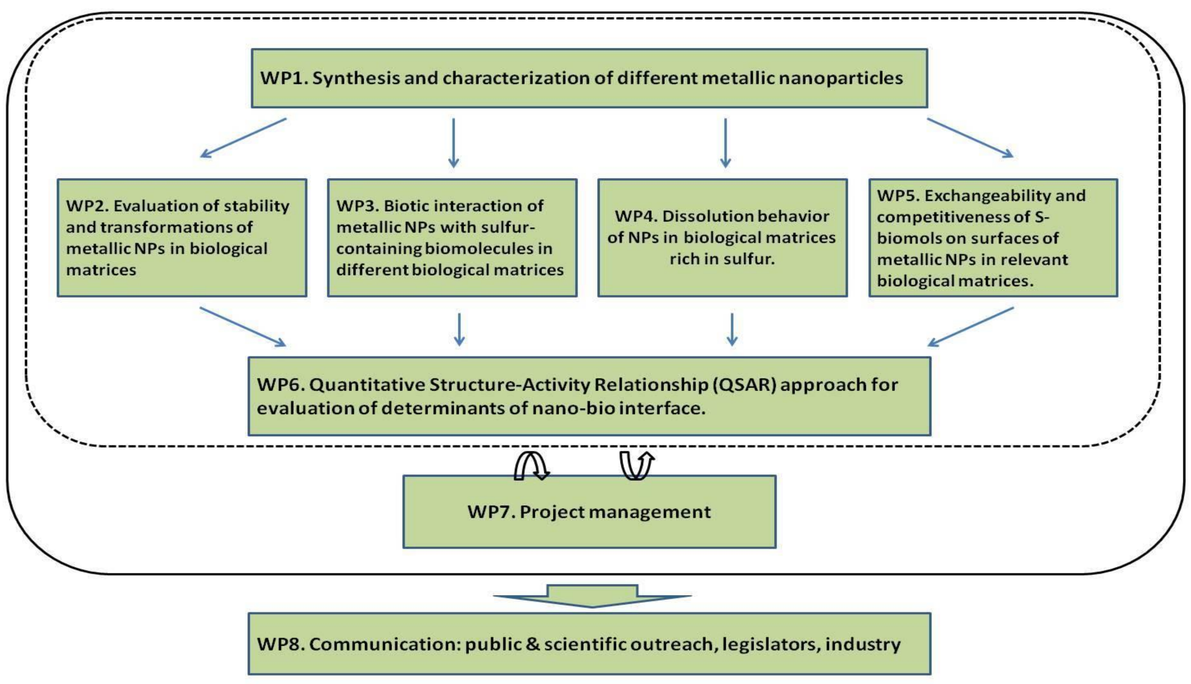
Nanomedicine, the application of nanotechnology to healthcare, has a great impact on innovation of medical treatments and therapies. Nanoparticles (NPs) have an enormous potential in the medical arena as drug and gene delivery vehicles, fluorescent labels and contrast agents. However, extensive *in vivo* applications of NPs require a more exhaustive exploration of the physicochemical and physiological processes coupled with introduction of NPs to biological environments. The dynamic physicochemical interactions, kinetics and thermodynamic exchanges between NPs surfaces and the surfaces of biological components give rise to the 'nano–bio' interface. It is impossible to inevitably describe all events at this interface, but additional information on the more specific interplay of NPs with bioactive components of living cells and tissues are of the highest relevance for prospective evolution of nanomedicine. The NanoFaceS project provides a body of new information and knowledge to the nanomedical endeavor in addressing the scientific uncertainties related to the beyond-state-of-the-art interaction of engineered metal-based NPs, used in theranostics, with sulfur-containing biomolecules (S-biomols), important in living systems due to their complex functional roles. NanoFaceS uses a model system comprising (i) a set of silver, gold and iron oxide NPs with varying physico-chemical properties, i.e. size, surface charge and chemical composition and (ii) representative S-biomols: cysteine, glutathione, metallothionein, albumin and insulin. The underlying concept of NanoFaceS is based on the understanding of interactions between NPs and S-biomols by implementing multimethodological and multidisciplinary approach which yields competence on biological consequences of NPs interaction with S-biomols. As a major outcome, the project provides substantial knowledge to the nanomedical landscape.




## GOALS

1. Synthesis and full characterization of metal-based nanoparticles with a range of physicochemical properties
2. Evaluation of stability and transformations of metallic NPs in various inclusion test media which can alter their chemical and/or structural nature
3. Establishing an understanding of biotic interactions of NPs with sulfur-containing biomolecules within specific simulated experimental and biological matrices
4. Dissolution behavior of NPs in biological matrices rich in sulfur
5. Exchangeability and competitiveness of important sulfur-containing biomolecules on surfaces of metallic NPs in relevant biological matrices
6. Quantitative Structure-Activity Relationship (QSAR) approach for evaluation of determinants of nano-bio interface




## RESULTS

### 2 book chapters

Vinković Vrček, I. Selenium Nanoparticles: Biomedical Applications. In: Selenium, Michalke B (ed). Berlin, Germany : Springer International Publishing, 2018, p. 393-412.
Ljubojević M; Milić M; Vinković Vrček I. Chapter 10. Environmental impacts of silver from spent nanosources. In: Silver Recovery from Assorted Spent Sources, Sabir S (ed). Oxford, United Kingdom : World Scientific Publishing Co. Inc., 2018, p. 303-344.

### 12 scientific papers


Pem et al. *Beilstein J Nanotech.* **2019**, 10, 1802.
Barbir et al. *Part Particle Syst Char.* **2019**, 37.
Rosenberg et al. *PeerJ.* **2019**, 7, e6315.
Oliveira et al. *Adv Healthc Mater.* **2018**, 1801233.
Capjak et al. *Environ Sci - Wat Res.* **2018**, 4, 2146.
Pem et al. *Methods Appl Fluores.* **2019**, 7, 014001.
Michalke et al. *J Chromatogr A.* **2018**, 1572, 162.
Pongrac et al. *J Trace Elem Med Bio.* **2018**, 50, 684.
Kubo et al. *Colloid Surface B.* **2018**, 170, 401.
Brkić Ahmed et al. *Food Chem Toxicol.* **2017**, 107, 349.
Ahonen et al. *Int J Environ Res Pub He.* **2017**, 14, 366.
Capjak et al. *Arh Hig Rada Toksiko.* **2017**, 68, 245.


### 1 doctoral thesis

Capjak, Ivona. Effect of size, shape and surface structure of silver nanoparticles on their interaction with model proteins. Zagreb: Faculty of Pharmacy and Biochemistry, 2019.

### 2 master theses

Galić, Emerik. Utjecaj nanočestica srebra na vijabilnost i oksidativni stres ljudskih keratinocita. Zagreb: Faculty of Science, 2019.
Pezo, Anuka. Karakterizacija nanočestica srebra i njihova interakcija s alfa kiselim glikoproteinom. Zagreb: Faculty of Pharmacy and Biochemistry, 2018.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