Evaluation of the potential use of noble metal nanoparticles as drug delivery platforms in an experimental model of inflammatory bowel diseases

Inflammatory bowel diseases (IBD) are a group of inflammatory conditions of the gastrointestinal tract. Crohn's disease (CD) and ulcerative colitis (UC) are the most prevalent types of IBD. IBD severely decreases patient's quality of life, moreover, IBD complications may be fatal. Unfortunately, the incidence of IBD is increasing worldwide. It is estimated that in Europe 1 million people suffer from UC and 1.4 million people suffer from CD. The etiology of IBD remains unknown, however, some environmental and genetic factors have been reported. Also, the role of gut microbiota in the pathology of the diseases is suspected. Pathophysiology of IBD is complex with yet not fully explained role of innate and adaptive immune mechanism, platelets, photogenic angiogenesis, and others. IBD are chronic diseases and there is no cure for them, drugs are only used to alleviate symptoms. Mesalazine, steroids, cyclosporin A, mercaptopurine, methotrexate, and biological therapies are used in IBD management.

Usage of nanoparticles (NPs) in IBD seems to be an interesting approach. NPs have a high surface to volume ratio which allows to decrease the dosages of therapeutic agents. Therefore, it reduces the side effects and costs of therapy. Also, NPs can easily penetrate through tissues, which makes them perfect drug delivery platforms. However, studies reporting NPs cytotoxicity to eukaryotic cells significantly limited their usage in the clinic. It was showed that NPs functionalization significantly decreases their cytotoxic effect, whilst not compromising positive effects.

In the project, we aim to synthesize, characterize, and evaluate in biological systems nanoparticles (NPs) conjugates with immunosuppressive drugs as therapeutic agents in IBD. It will be the first project in which such nanomaterials will be synthesized, characterized, and evaluated in the biological model. We will evaluate the safety and effectiveness of nanomaterials *in vitro, ex vivo*, and *in vivo*. We aim that nanoparticles, as drug delivery platforms, will have anti-inflammatory and antimicrobial properties. We expect a synergist anti-inflammatory effect of drugs and nanoparticles.

The proposed study may lead to the usage of NPs as drug delivery platforms in IBD. Moreover, the unique synthesis of NPs, will provide valuable information about their therapeutic properties, contributing to their possible application in human disease management.