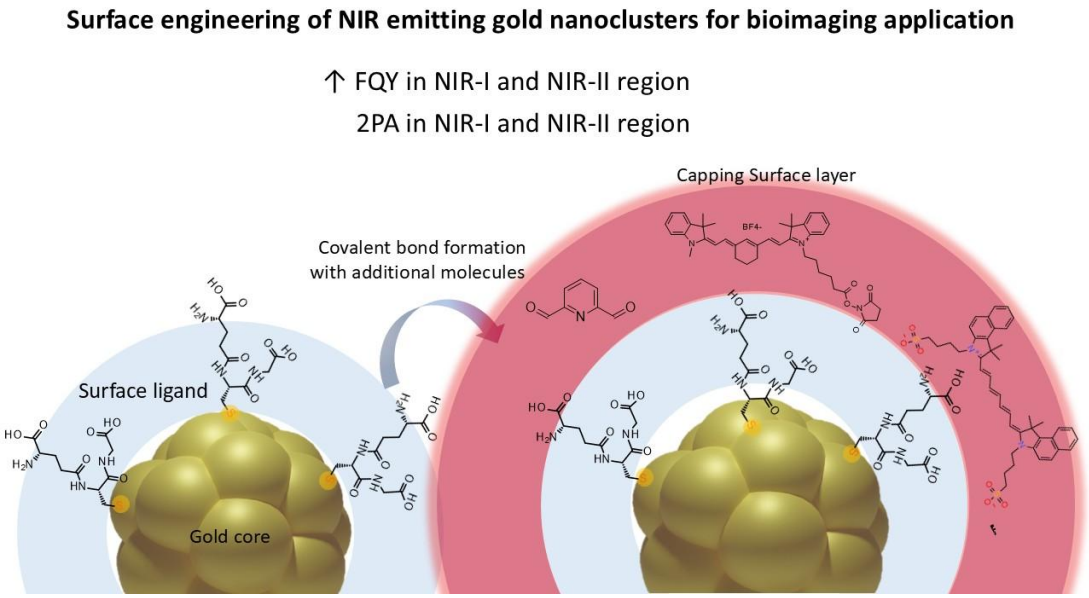


*Figure 1 Schematic representation of enhanced emission upon attaching capping surface layer to glutathione stabilized gold nanoclusters. In the blue are surface stabilizing ligands, in the pink is schematic capping surface layer with additional molecules.*

**The goal of this project is to improve the light-emitting properties of gold nanoclusters by modifying their surface. These specially engineered nanomaterials will be water-soluble and optimized to serve as fluorescent probes that emit in the so-called "biological windows" – ranges of near-infrared light (NIR) that allow deep tissue imaging using one- and two-photon fluorescence microscopy.** Gold nanoclusters are extremely small particles made of a specific number of gold atoms, such as $Au_{18}$ or $Au_{25}$. Their surfaces are covered with organic molecules called ligands, which play a key role in determining how the nanoclusters behave – including whether and how they emit light. This project will explore how changing the ligand shell affects the emission of light in the NIR-I range (700–1000 nm) when the clusters are excited by two-photon light. For the first time, emission in the NIR-II range (1000–1700 nm) under two-photon excitation will also be studied for these systems. The most promising nanocluster candidates will be selected and tested in biological models. During the project, clusters with water-soluble ligands will be further modified using functional groups already present in their structures. This will allow the attachment of small organic molecules that form an outer layer, further tuning their light emission properties under one- and two-photon excitation. This surface engineering strategy focuses on modifying the ligand shell without changing the gold core itself. The expected outcome is the development of optimized fluorescent markers for advanced bioimaging applications in the NIR-I and NIR-II biological windows.