

# NANO-BIO INTERACTIONS OF SURFACE FUNCTIONALIZED NANOPARTICLES

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## Introduction

The aim of this project is to provide new information on the protein corona formation, the first reaction of a living organism to the administration of nanoparticles (NP), with particular attention to the recruitment of proteins capable to induce an immune response.

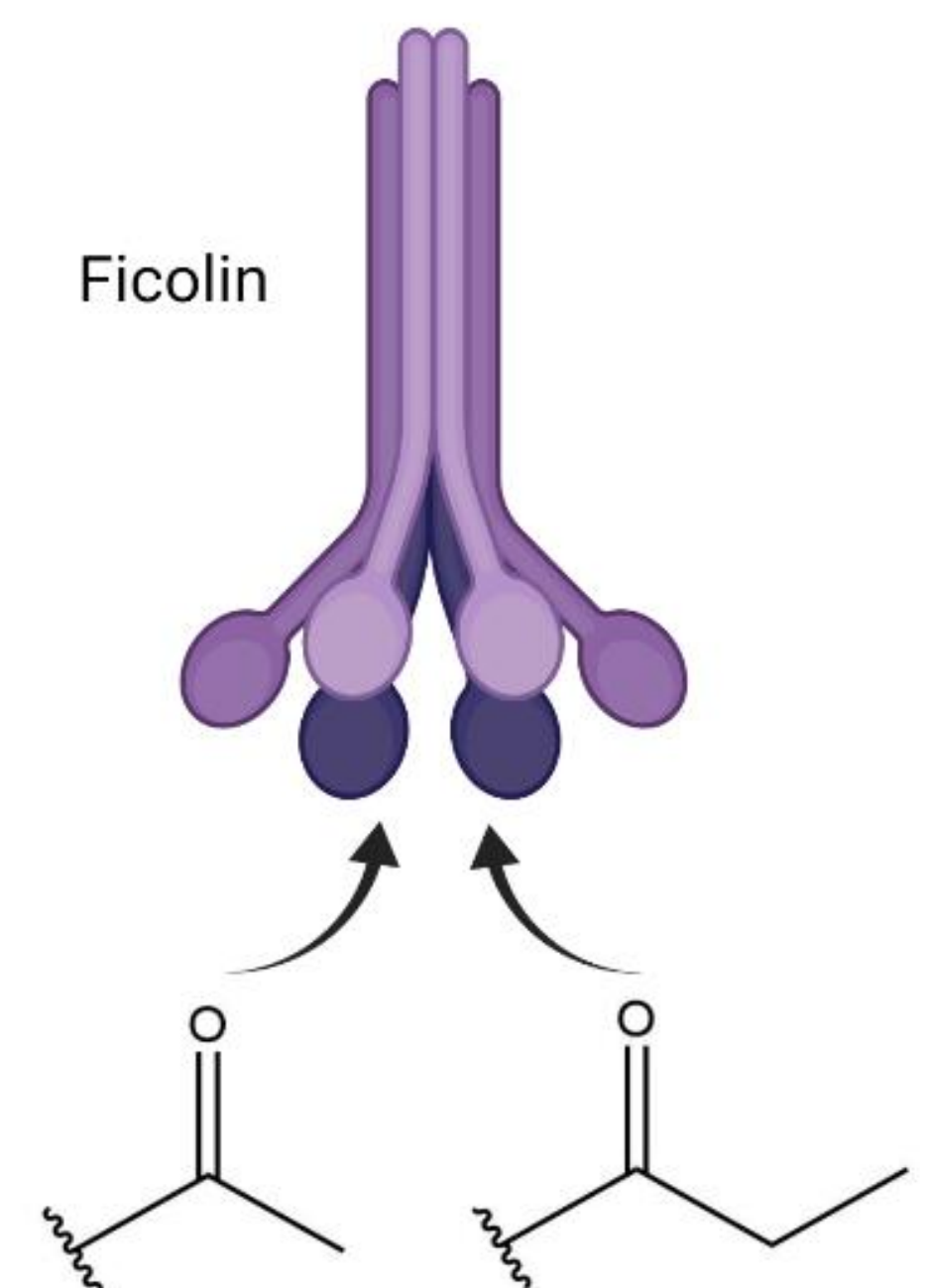
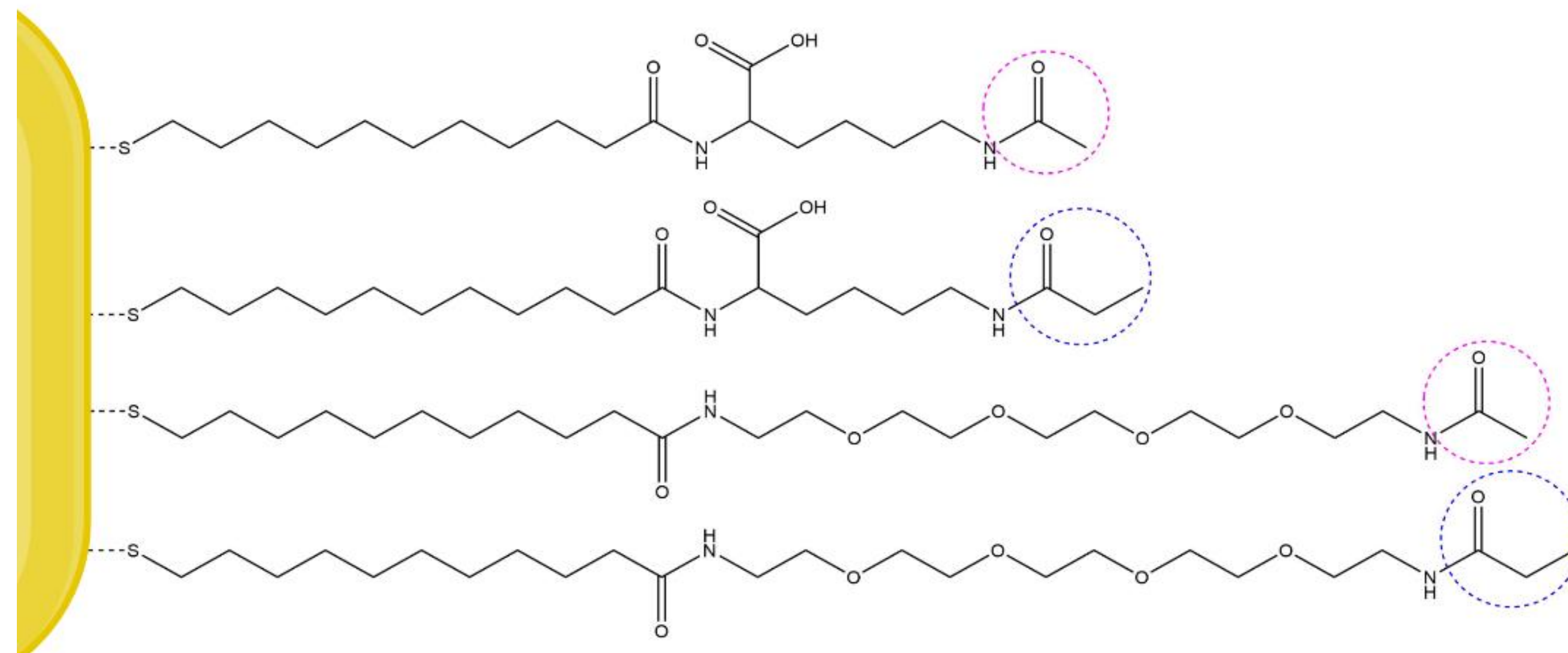
In this perspective, we synthesized 10-nm gold NPs coated with molecules featuring acetylamine and propionylamide groups.

To graft the two amide groups to the NPs we selected two scaffolds: a PEG diamine, providing water solubility and neutral charge to

the NPs, and a  $\omega$ -acylated lysine, providing water solubility and negative charge.

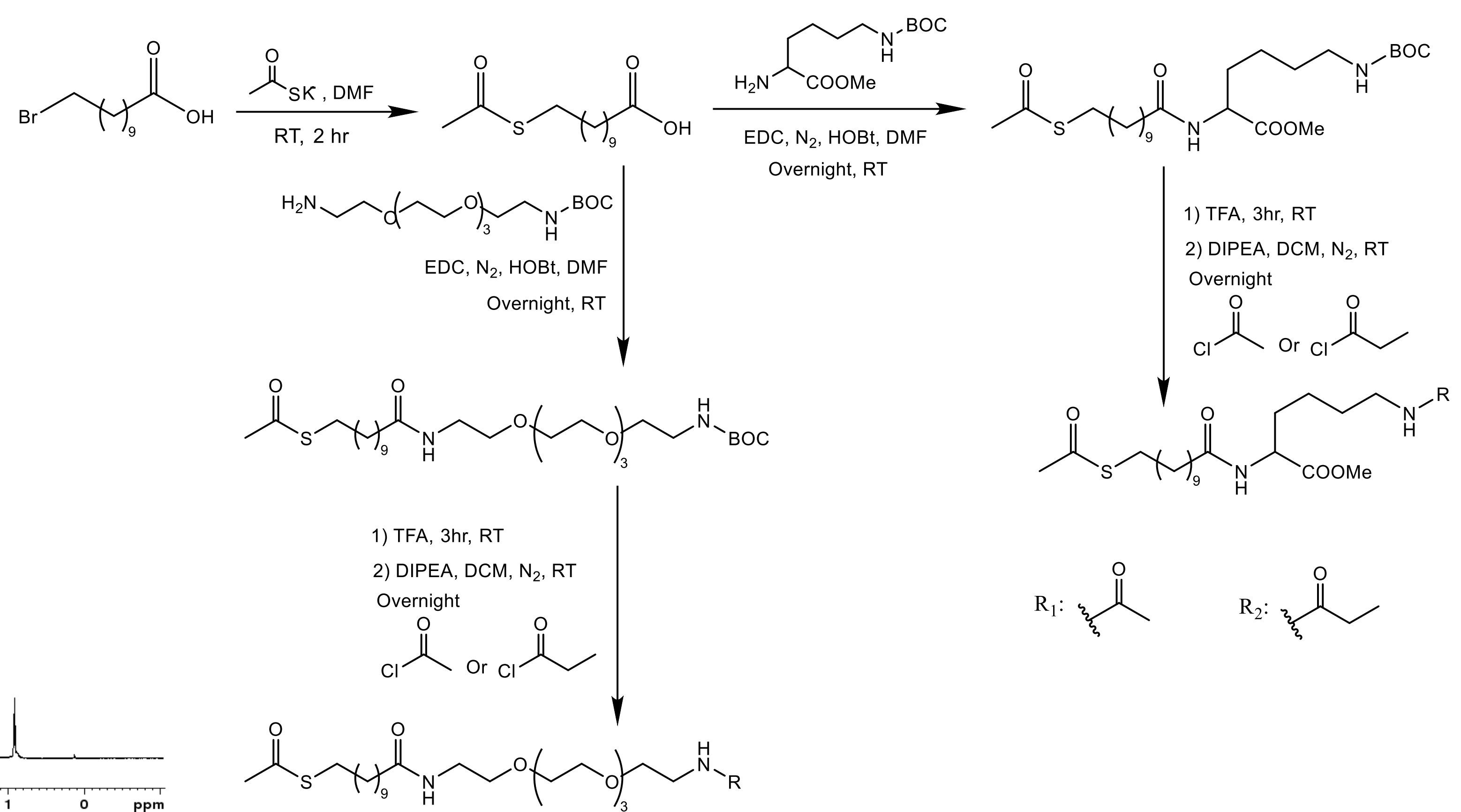
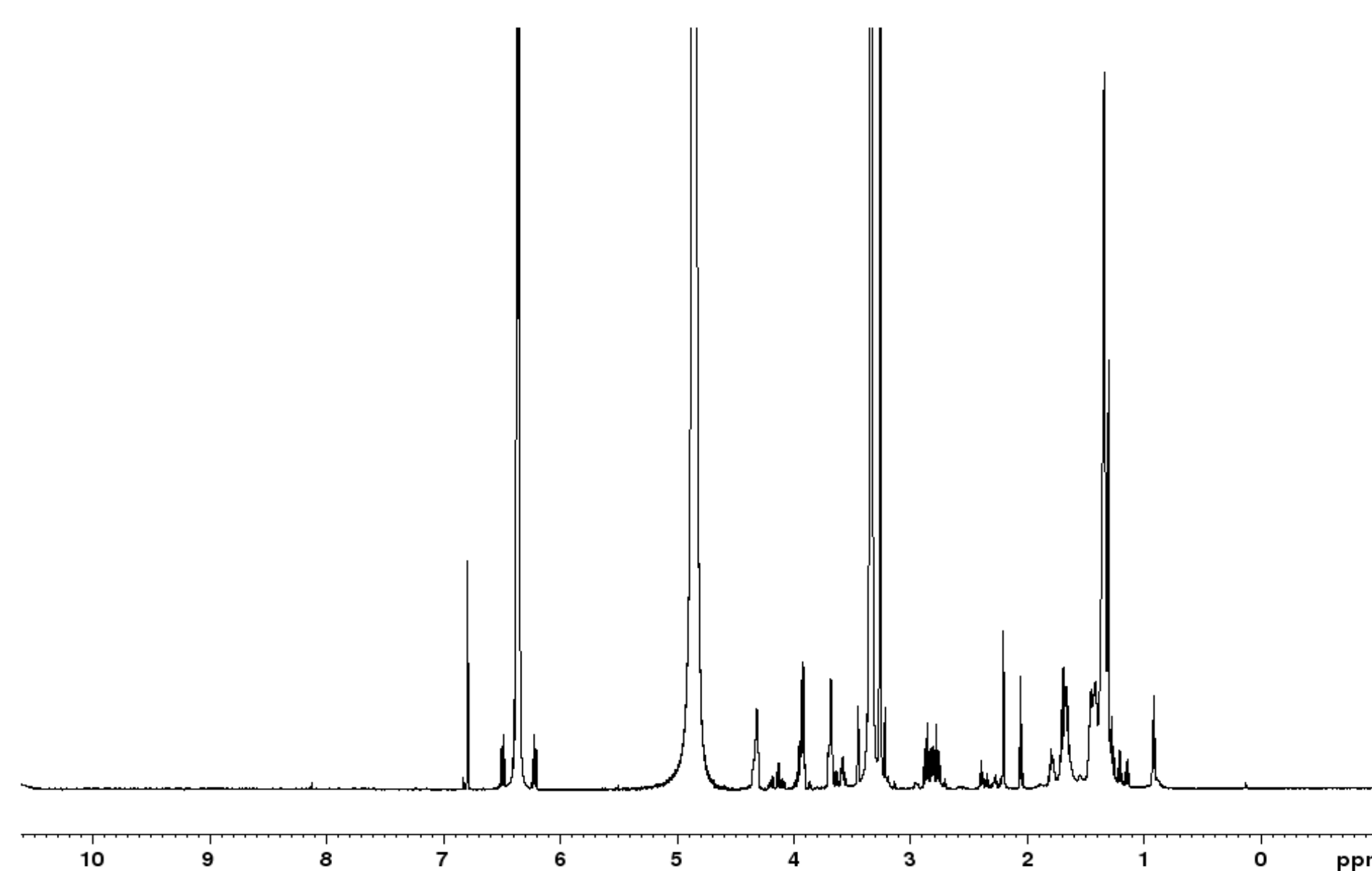
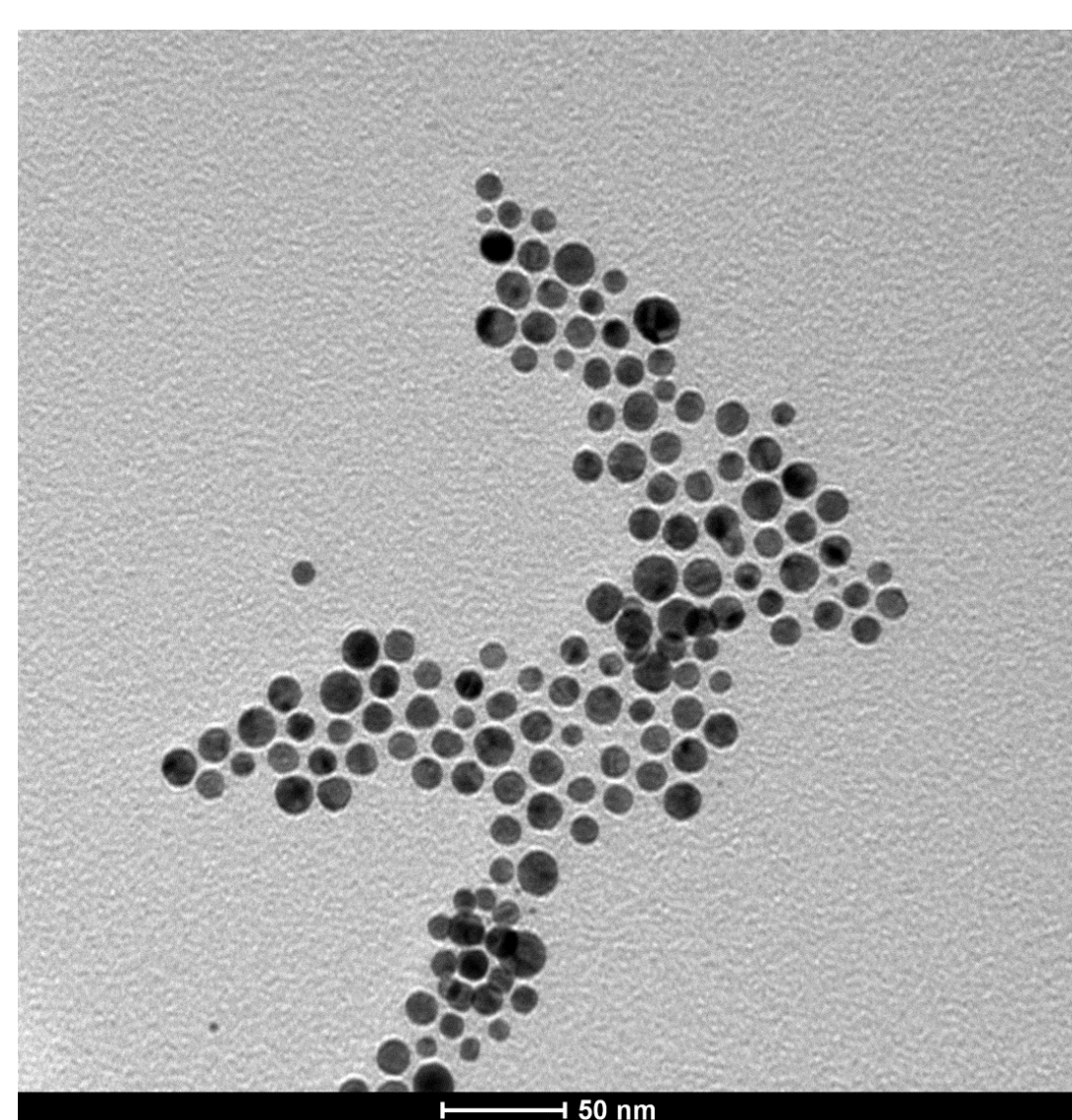
Preliminary experiments shown the enrichment of ficolins in the corona formed by the NPs after incubation in serum.

The presence of this class of proteins in the corona is quite relevant since they are triggers the innate immune response.



## Synthesis and characterization

Dynamic Light Scattering (DLS) • Zeta-potential  
Transmission Electron Microscopy (TEM) • Thermogravimetric analysis (TGA) • Nuclear Magnetic Resonance (<sup>1</sup>H NMR)



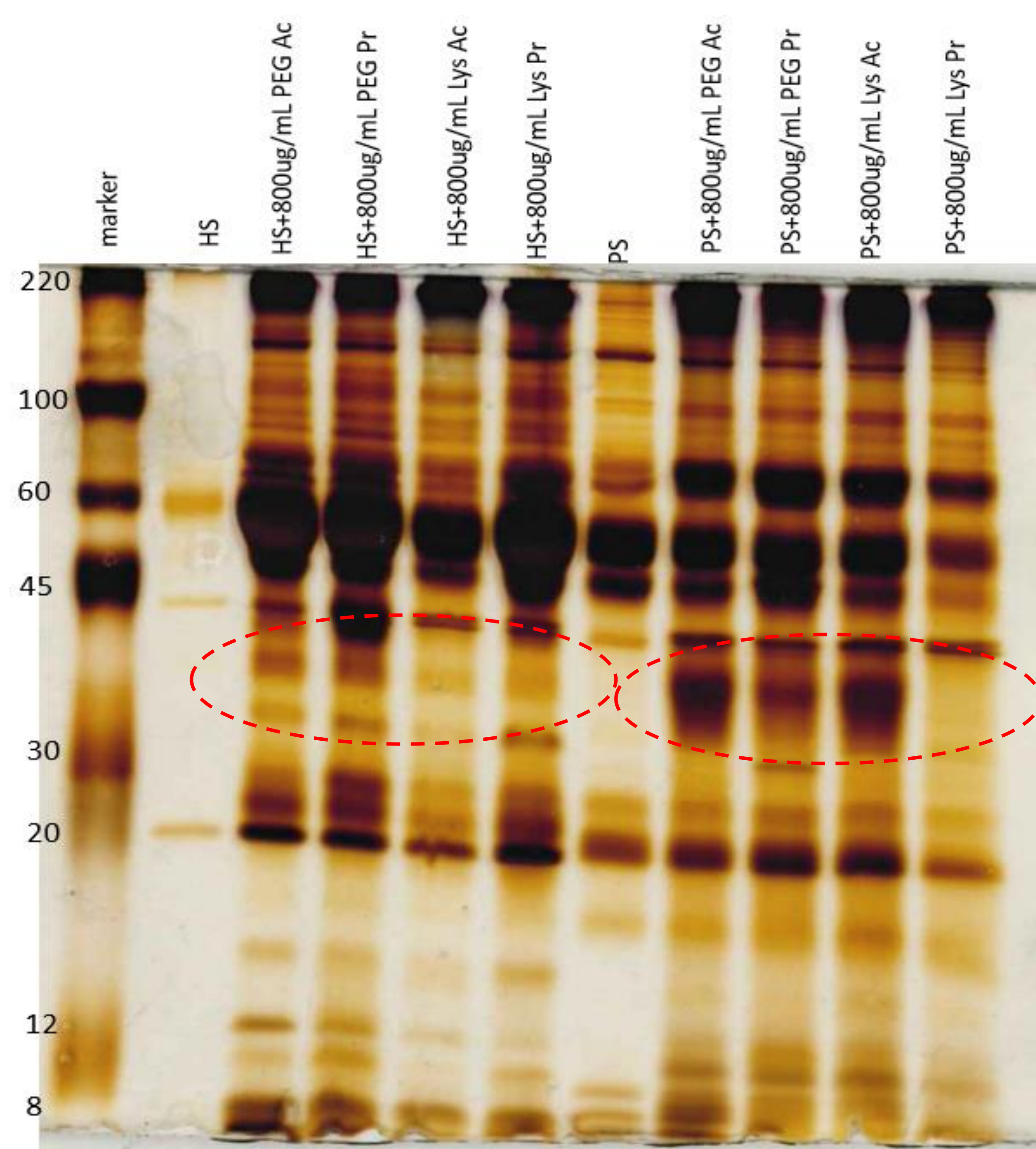
## Preliminary biological studies

HS: Human Serum | PS: Pig Serum

The range between 37-38kDa could indicate the presence of Ficolins.

Upon incubation with Human Serum the presence of a small amount of ficolins in the NPs corona was detected, in particular with PEGylated coatings. In Pig Serum a much more significant presence of these proteins was observed, in particular with the acetylated and PEGylated coatings.

Propionylated domain could not fit in the ficolin binding site due to the larger alkyl chain or the charge repulsion for the lysine carboxylate. In addition, pig serum apparently contains a larger amount of ficolins or ficolins with greater affinity.



## Conclusion

It was possible to identify the selective binding of ficolins to NPs with acetylated coatings, but not to those with propionylated coatings, suggesting that ficolins have a strong affinity with the acetylated site. While other studies are ongoing to obtain more detailed understanding of this process (in-gel mass spectrometry and shot gun mass spectrometry), this finding is relevant as the acetyl group is quite ubiquitous in different polymers and biopolymers used for the passivation of nanoparticles for biomedical applications.

**DIRNANO**

Directing the immune response through designed nanomaterials

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