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Immunological mapping of the biomolecule corona of nanoparticles

Within the DIRNANO project ESRs are actively working on novel coatings to increase the nanoparticle's(NP) biocompatibility. My primary objective in STAB VIDA, Caparica (Portugal) is to develop new isothermal nucleic acid amplification technology-based immunoassays (similar to ELISA-PCR) using Doctor Vida® pocket platform developed by STAB VIDA and monoclonal antibodies to detect, map and quantificate the biomolecular corona that form on the NP surface.

The molecular biocorona formed in host fluids like the serum on NP may be complex and change depending on the kind of NP-coatings, even with supposed stealth polymers, and also on species. Formation of the biocorona on the surface of NP is a significant obstacle to the development of safe and effective nanotechnologies, especially for nanoparticles with biomedical applications. The addition of these biomolecules alters the NP's physicochemical characteristics, functionality, biodistribution, and toxicity. Antibody tools are a major and most effective means to map the corona component, validate proteomics data, and functionally determine the role of single host-derived factors.

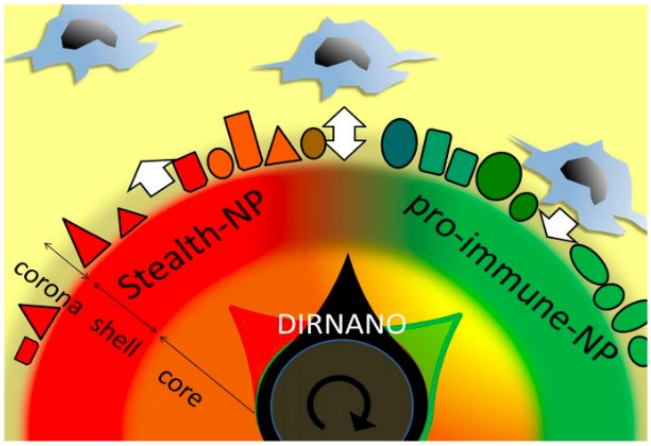

Figure 1. DIRNANO.

Challenges in Nanotechnology and Biomedicine:

While nanoparticles offer tremendous potential, the bioprotein corona presents a significant challenge in developing safe and effective nanotechnologies, particularly those aimed at biomedical applications. This corona alters the physicochemical characteristics, functionality, biodistribution, and toxicity of nanoparticles, underscoring the need for a comprehensive understanding of these complex interactions.

Antibodies as Precision Tools in Mapping the Bioprotein Corona:

Hybridoma technology is a classic method for developing monoclonal antibodies, crucial tools in various research fields, diagnostics, and therapeutics. The hybridoma technique has traditionally stood out as one of the most prevalent and respected approaches for generating monoclonal antibodies.

This technique combines the unique attributes of B lymphocytes and immortalized myeloma cells to create hybrid cell lines capable of producing a single, particular antibody type. Key steps involve immunizing an animal to stimulate antibody production, isolating antibody-producing B cells, fusing them with myeloma cells to form hybridomas, and selecting hybridomas that produce the desired antibody.

The resulting monoclonal antibodies offer unparalleled specificity and reproducibility, making hybridoma technology an indispensable asset in biotechnology and biomedical research.

This immunological mapping not only aids in characterizing the biocorona but also holds promise for optimizing nanoparticle-based drug delivery systems. Understanding the impact of the biomolecule corona on factors such as biodistribution, cellular uptake, and therapeutic efficacy is fundamental for developing targeted and efficient treatments. As the field advances, the knowledge gained from immunological mapping contributes to the design of nanotechnologies that can navigate the challenges posed by the biocorona, ensuring their safety and efficacy in biomedical applications.

Biomedical Implications:

In medicine, decoding the bioprotein corona is pivotal for optimizing nanoparticle-based drug delivery systems. Understanding its impact on biodistribution, cellular uptake, and therapeutic efficacy is essential for developing targeted and efficient treatments while minimizing potential side effects.

DIRNANO NEWS

ESR2, Pedro Veloso has just returned to Paris Lodron University of Salzburg (Austria) for his 2nd secondment, where he will be characterizing the phenotype of dendritic cells stimulated with poly(oxazoline)--coated nanoparticles

ESR5, Carlos Pavón Regaña has recently completed his three-month secondment at the University of Verona (Italy) under the supervisor of Prof. Roberto Fiammengo.

NEWS IN THE FIELD

PEGS conference - the essential protein and antibody engineering summit will occur in Boston, US on May 13-17 2024.

Lucía Abarca-Cabrera has published the study on biocorona: “Biocorona on Iron Oxide Nanoparticles in a Complex Biotechnological Environment: Analysis of Proteins, Lipids, and Carbohydrates”.

Edward B. Irvine has recently published a study on the use of artificial intelligence methods to develop antibodies: “Computational and artificial intelligence-based methods for antibody development”.

Margarita Kislukhina ESR11,
STAB VIDA

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