

Decoding Bio–Nano Interactions: From Protein Corona Formation to Cellular and Membrane Responses.

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Despite significant advances in nanotechnology, the number of clinically approved nanomedicines remains limited. Current approvals are largely driven by improved safety profiles rather than enhanced therapeutic efficacy. A major barrier to successful translation is the incomplete understanding of how nanosystems interact with biological environments. This work focuses on elucidating the biological identity of nanosystems under physiologically relevant conditions. In particular, we investigate how interactions with biological fluids lead to the formation of protein corona complexes, which critically influence nanoparticle behavior, targeting, and cellular responses¹⁻³. We present recent findings on the interactions between biomolecules and nanosystems with model lipid membranes and living cells in protein-rich environments. These studies highlight how the presence of biological fluids modulates bio–nano interactions, ultimately affecting membrane dynamics, cellular uptake, and biological outcomes. A deeper understanding of these processes is essential for the rational design of more effective and reliable nanomedicine platforms.

Keywords:

nanoparticles, protein corona, lipid bilayers, scattering

References:

References

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Acknowledgements:

Acknowledgements. Thanks for funding to the INNOVA project (funded by Ministero della Salute, PNC-E3-2022-23683266) and PRIN 2022 PNRR - project P2022RBF5P - Lancelot – (funded by MUR) supported by Next Generation EU.