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Abstract

Proteins, with their exceptional structural versatility, biocompatibility, and biodegradability, are emerging as powerful tools in both biomedicine and technology. In particular, we focus on engineered repeat proteins, a class of proteins known for their stability, robustness, and ability to be tailored for specific functions and supramolecular assembly properties.

We have developed strategies to create ordered protein-based biomaterials by re-engineering protein-protein interactions.[1,2,7] Furthermore, by incorporating metal-binding residues such as histidines and cysteines, we can drive metal coordination, leading to the formation of tailored protein-nanomaterial composites.[3] These composites take advantage of both the unique properties of proteins and nanomaterials, resulting in hybrid systems with novel functionalities.[3,4,5]

These composites extend the use of protein-based nanomaterials beyond their original therapeutic scope, enabling their application as theranostic agents, as demonstrated in our pioneering in vitro and in vivo studies.[4,5] Moreover, these protein hybrids show promise in technological applications, including catalysis,[2,3] and bioelectronic materials. [6,7]

References

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Biosketch

Aitziber L. Cortajarena is an Ikerbasque Research Professor and Scientific Director at CIC biomaGUNE, where she leads the Biomolecular Nanotechnology Laboratory. Her research focuses on protein engineering and the development of functional biomaterials and nanostructures for biomedical and technological applications.

She has authored over 100 peer-reviewed publications, with more than 4,460 citations, and holds 5 granted patents. Her contributions have been recognized with prestigious awards, including the Horizon Prize from the Royal Society of Chemistry, the Research Excellence Award from the Spanish Royal Society of Chemistry, and the Women in Science Career Award from Ikerbasque.

Prof. Cortajarena serves as Senior Editor for Protein Science (Wiley) and was previously Associate Editor at ACS Applied Biomaterials. In 2023, she was elected a member of the Spanish Royal Academy of Sciences. She is Vice President of the Spanish Biophysical Society and a member of the Executive Committee of the European Biophysical Societies' Association.

An experienced mentor, she has supervised 23 Master's students, 20 PhD candidates, and 16 postdoctoral researchers in the past five years. She teaches in several Master's programs and has been an Associate Professor of Medicine at the University of Deusto since 2020.

Prof. Cortajarena has secured significant European funding, including an ERC Consolidator Grant (ProNANO), two ERC Proof-of-Concept grants (NIMM, NanoImaging), an ERA-CoBioTech project (coordinator), four FET-Open projects (e-Prot, ARTIBLED, FairyLights, DeDNAed), and an EIC Pathfinder project (iSenseDNA). Her work bridges fundamental protein research with practical applications in technology and medicine.

In 2024, she co-founded Taldeki Biosolutions, a spin-off from CIC biomaGUNE, supported by Basque Tek Ventures. Taldeki develops metal-protein hybrid nanosensors for rapid and cost-effective antibody detection, aiming to transform disease diagnostics, particularly in areas like infectious and autoimmune diseases. The technology, based on over a decade of research led by Prof. Cortajarena, offers advantages over traditional antibody-based diagnostics, including greater stability, reproducibility, and adaptability to various biomarkers.