CIC biomaGUNE
CENTER FOR COOPERATIVE RESEARCH IN BIOMATERIALS

PRESS RELEASE

A team from CIC biomaGUNE develops novel protein-based functional nanomaterials

The research, led by Ikerbasque Research Professor Aitziber López Cortajarena, has been published in the journal Angewandte Chemie

The work has succeeded in designing proteins, via incorporation of metal coordination sites, for the sustainable synthesis of metal nanoclusters with different metal composition

(Donostia-San Sebastián, 24 April 2019). A team from CIC biomaGUNE has succeeded, through an ERC Consolidator Grant within the ProNANO Project, in developing novel protein-based functional nanomaterials. The research, led by the Ikerbasque Research Professor Aitziber López Cortajarena, has pioneered a simple and versatile strategy for designing proteins, via incorporation of metal coordination sites, for the sustainable synthesis of metal nanoclusters with different metal composition. Metal nanoclusters are nanomaterials only consisting of between 5 and 50 metal atoms.

The work, published in the journal Angewandte Chemie, explains that the resulting protein-stabilised nanoclusters of gold, silver and copper are highly photoluminescent, photostable and biocompatible. As Aitziber López Cortajarena, Ikerbasque Research Professor and Biomolecular Nanotechnology Group leader in CIC biomaGUNE, explains: “These nanomaterials are capable of entering living cells without affecting cell viability or losing their luminescence, making them useful tools for imaging and labelling living cells. Furthermore, this approach is so general that it is translatable to other proteins to obtain hybrid proteins-nanoclusters for various biomedical applications, such as cell imaging or labelling”.

Biological systems for the production of advanced tools

This study paves the way for the design of new tools and technologies, based solely on proteins, to generate new controlled synthesis pathways of nanomaterials with certain properties for application in different fields. It should be noted that, by using biomolecules as the main raw material and water as the solvent, new synthesis routes can be developed that are more biocompatible and sustainable than those traditionally used in the synthesis of this type of nanomaterial. Therefore, this is an example of how, starting from protein design, biological systems can be used in the production of advanced tools with multiple applications.

The systems developed in this research open the door to numerous applications, such as advanced tools for imaging and labelling living cells; sensors to verify changes in temperature and pH or detection of pollutants; detection agents in fluorescence-based diagnostic tests; and theranostic (therapy and diagnosis) tools that combine inhibition of disease-related pathways with fluorescence properties that enable the monitoring of active molecules.

Aitziber López Cortajarena adds: "The main difficulties encountered in the course of this project have been related to characterising these new hybrid systems of proteins with metal nanoclusters, on account of their hybrid nature and heterogeneous character".

This research, which started in 2016, has mostly been conducted in the CIC biomaGUNE Biomolecular Nanotechnology Group coordinated by Prof. Cortajarena, with Dr. Antonio Aires as post-doctoral researcher and first author of the work. Other participants include members of CIC biomaGUNE platforms such as Dr. Irantzu Llarena (optical microscopy) and Marco Moller (electron microscopy), as well as collaborators of IMDEA Nanociencia (Madrid) for the photophysical characterisation of the systems.

About CIC biomaGUNE

The Center for Cooperative Research in Biomaterials (CIC biomaGUNE), located in the Gipuzkoa Science and Technology Park, conducts cutting-edge research at the interface between Chemistry, Biology and Physics, and particularly on the properties of molecular level biological nanostructures and their biomedical applications.

CIC biomaGUNE was accredited in 2018 as a "María de Maeztu" Unit of Excellence after assessment of its compliance with a series of excellence requirements characterised by a high impact and level of competitiveness in its particular field of activity and in the scientific arena worldwide. The center's research activities are not only regularly subjected to scientific assessment processes conducted by an external and independent committee of scientists, but are frontier research actions developed in line with a strategic program. Furthermore, the centre also selects, trains and attracts talent on an international level, has active partnership and exchange agreements on an institutional level with other top-level research centers and promotes activities for the transfer and dissemination of knowledge to society at large.

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