SEMINAR CYCLE

of the PhD in Neuroscience of Turin

3rd Appointment

Prof. Jesus de la Fuente

Institute of Nanotechnology and Materials of Aragón,
CSIC/ University of Zaragoza

"Designing Biofunctional Nanoparticles"

14th March, 2024 h 9:30 AM-11:30 AM

The lecture will last 1 hour and it will be followed by discussion

Host: Prof. Giovanna Gambarotta

Seminar Room, University Didactic Center, San Luigi Gonzaga Hospital, Department of Clinical and Biological Sciences, Regione Gonzole 10, 10043 Orbassano
Link: https://unito.webex.com/meet/giovanna.gambarotta

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PROF. JESUS DE LA FUENTE

Dr. J.M. de la Fuente (Barakaldo, 1975) started his PhD work in 1999 working in the evaluation of carbohydrate-carbohydrate interactions using gold nanoparticles in the Institute of Chemical Research from CSIC (Spanish National Research Council). During his PhD, he prepared the first gold nanoparticles functionalized using biologically relevant oligosaccharides, providing the first thermodynamic data, adhesion forces and kinetic data of the carbohydrate-carbohydrate interactions for the antigen Lewis X and also intervened in biological processes. Once he obtained his PhD, he was funded by the Spanish Science Ministry to work in the Centre for Cell Engineering University of Glasgow (UK) to develop a research project involving the nanoparticles development and its biological application during two years. In July 2005, he went back to the Institute of Chemical Research (IIQ)-CSIC (Seville, Spain). His research was oriented to the vectorization of paramagnetic nanoparticles with biologically relevant carbohydrates to label and visualize brain tumors. In June 2007, he got a permanent position in the Institute of Nanoscience of Aragon (INA) belonging to the University of Zaragoza (Spain) as Senior Researcher supported by ARAID. He is actually leading the research group specialized in the Biofunctionalization of Nanoparticles and Surfaces. His research interest is based on the development of general and simple strategies for the functionalization of nanoparticles and surfaces for biomedical and biotechnological applications. He has actually more than 250 published articles with more than 14000 citations and 6 international patents (h factor: 68).

Since then, Dr de la Fuente has created a large research group with outstanding scientific results and excellence research projects. As principle investigator, he has received a European Research Council-Starting Grant for “Multifunctional Magnetic Nanoparticles: Towards Smart Drugs Design-NANOPUZZLE” (2010-2015), a European Research Council-Proof of Concept-HOTFLOW (2017-2018) and ERANET project “Multifunctional Gold Nanoparticles for Gene-Therapy-NANOTRUCK” (2009-2012), he is PI of a FP7-NMP “Nanotherapeutics for Antibiotic Resistant Emerging Bacterial Pathogens-NAREB” (2014-2018) and he has supervised 1 IOF and 2 IEF FP7 Marie Curie Fellows and 4 IF HORIZON2020 Marie Sklodowska-Curie Fellows. Since June 2014, he is back to CSIC and he is actually a permanent researcher of the Institute of Material Science of Aragon (CSIC-University of Zaragoza).

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ABSTRACT

Nanotechnology is considered by many to be the next "Technological Revolution". Thanks to this technology we can control materials at the nanoscale level and develop nanometric devices such as nanoparticles. Today there are a multitude of applications for these nanoparticles, ranging from fields such as electronics, communications, optics, chemistry, energy and of course also biology. Why are these nanoparticles interesting from a biotechnology application point of view? Mainly because these materials, due to their nanometric size, acquire different properties, thus creating new uses. It should also be borne in mind that it is in this nanometre range that all biomolecules such as DNA, proteins, carbohydrates, etc. are found. In recent years, a multitude of applications of nanoparticles have emerged in the field of biology, such as fluorescent labelling of proteins or high-resolution visualisation of organelles inside cells. The use of these "nanosystems" in the field of medicine has given rise to what is known as nanomedicine. Nanomedicine simply aims to exploit the interesting physical, chemical and biological properties of materials at the nanometric level to achieve major advances in improving healthcare. The main challenges Nanomedicine aims to achieve are to enable the early detection of different pathologies, helping to prevent these diseases, and on the other hand to improve treatments to make them more effective and with the lowest possible degree of side effects. The aim of these objectives is to improve the quality of life of the patient.

In our research group at the Institute of Nanotechnology and Materials of Aragon (INMA, CSIC/Univ Zaragoza), we are developing magnetic, gold and polymeric nanoparticles for application in cancer and neurodegenerative diseases, developing new therapies ranging from a controlled release of drugs in a preferential manner in the desirable tissue, and developing ultrasensitive biosensors for the diagnosis and prognosis of different pathologies. What is done is to use the nanoparticles as a drug transport system and to use the original properties of these nanomaterials to ensure the release of the drug only where it is desired. Moreover, thanks to the use of biological markers (molecules capable of directing these nanoparticles exclusively to specific areas), they will ensure a more effective treatment, reducing the dose and side effects.

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