



## Nanoactuators for Therapy and Diagnosis

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**10:00 a.m. - CiQUS Seminar Room**

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### Abstract

In the last decades, inorganic nanoparticles have been steadily gaining more attention from scientists from a wide variety of fields such as material science, engineering, physics, or chemistry. The very different properties compared to that of the respective bulk, and thus intriguing characteristics of materials in the nanometer scale, have driven nanoscience to be the center of many basic and applied research topics. Moreover, a wide variety of recently developed methodologies for their surface functionalization provide these materials with very specific properties such as drug delivery and circulating cancer biomarkers detection. In this talk we describe the synthesis and functionalization of magnetic and gold nanoparticles as therapeutic and diagnosis tools against cancer.

Gold nanoprisms (NPRs) have been functionalized with several biomolecules, aiming to enhance NPRs stability, cellular uptake, and imaging capabilities, respectively. Cellular uptake and impact were assayed by a multiparametric investigation on the impact of surface modified NPRs on mice and human primary and transform cell lines. Under NIR illumination, these nanoprobe can cause apoptosis. Moreover, these nanoparticles have also been used for optoacoustic imaging, as well as for tumoral marker detection using a novel type of thermal ELISA and LFIA nanobiosensor using a thermosensitive support.

**Keywords:** Gold Nanoparticles, Nanobiosensors, Nanoactuators, Photothermal Therapy, Hyperthermia

### Biosketch

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 Skłodowska-Curie Fellows.