



## INORGANIC NANOPARTICLES

Led by ICREA Prof. Víctor Puentes, the Inorganic Nanoparticles Group works on the synthesis, characterisation and applications of engineered inorganic nanoparticles. By controlling the size, structure and shape of the inorganic core and manipulating the linking of organic molecules to the nanoparticle surface, the Group aims to design nanoparticles that interact with a variety of systems (biological, medical, materials, etc.). This interaction allows for their modification or for witnessing and reporting things.

### BACKGROUND

Effective use of nanoparticles in medical and other applications requires precise control and quality assurance throughout the entire manufacturing process, from the design and synthesis of the inorganic nanoparticle to its customisation and monitoring of its full life cycle. Intended uses and fields of application include: drug delivery, nanotoxicology studies, environmental remediation, immunology, catalysis for energy, and control of cell-response. With nanotechnology in its early stages, this level of control has yet to be widely achieved. The Group aims to develop world-leading expertise in the manufacture and characterisation of high quality engineered inorganic nanoparticles for use in a wide range of applications.

### RESEARCH ACTIVITIES INCLUDE:

**Synthesis of Inorganic Nanoparticles.** Developing consistent synthesis protocols for metallic and semiconductor nanoparticles, their alloys and core-shell structures. The protocols must be robust enough to allow the simple (scalable) production of monodisperse nanoparticles with controlled size, composition and shape.

**Characterisation of Inorganic Nanoparticles.** Studying the structure of particles and correlating it with observed physico-chemical properties. Special focus is given to optical and magnetic properties, to enable connection and feed-back between synthesis and the final material.

**Self Assembly.** Exploring the phenomena of spontaneous self-assembly of nanoparticles with particular focus on the self-conjugation of biological molecules to inorganic nanoparticles.

### Application of inorganic-biomolecule nanoparticle conjugates to biomedicine.

Developing biomedicine applications in diagnosis and treatment of diseases, including stimulation of the immune system, utilising the conjugation of inorganic nanoparticle to biological molecules.

**Safety & Environmental studies.** Studying the environmental and human nanotoxicology of the particles and conjugates utilised in the Group's research activities.



ICREA PROF. VÍCTOR PUNTES  
GROUP LEADER

Prof Victor Franco Puentes studied chemical engineering at the European High Institut of Chemistry of Strasbourg (now IPCMS), France, in materials sciences, ending in 1994. He obtained his PhD at the Physics Department at the University of Barcelona (1998), on Giant Magnetoresistance in granular alloys, in collaboration with research groups at the University of Coventry and North Wales University where he spend a year of his PhD program. He spent 4 years at Berkeley in a postdoctoral position, first in the group of professor Krishnan Kannan (National Center for Electron Microscopy, Lawrence Berkeley Laboratory) and then in the group of professor Paul Alivisatos (College of Chemistry, UC Berkeley). After moving to the Physics department at the University of Barcelona with a Ramon y Cajal position in 2003, he obtained in 2005 an ICREA Professorship at the Catalan Institute of Technology (ICN) in Barcelona, Spain, to create the Inorganic Nanoparticles Group dedicated to the synthesis, characterization and applications of engineered inorganic nanoparticles.

