TFM or PhD offers:

Understanding the magnetic behavior of single molecule magnets on magnetic surfaces for spintronic applications

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Research groups: Grup de Magnetisme i Molècules Funcionals (Facultat de Química).

Websites: GMMF: http://www.gmmf-ub.com

Description of the project:

Lanthanide single molecule magnets (SMMs) are now on the fast track for implementation of molecular spintronic devices, in particular after discovery of an organometallic SMM that shows hysteresis above liquid nitrogen temperature: an SMM can be operational at a temperature that is technologically easy to achieve, this is an very important breakthrough in the field since up until now all SMMs were only operational at liquid Helium temperatures (Layfield et al. Science, 2018). For molecular spintronics, SMMs must be manipulated and deposited on surfaces.
In this project you will work in a multidisciplinary environment. The main goal is the synthesis of new lanthanide SMMs and their deposition on surfaces.

Luminescent nanosheets: Van der Waals 2D materials

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Description of the project:

Lanthanide complexes can show very interesting magnetic properties but also luminescence. This has many important applications in sensors, smart inks, imaging, etc....
Two dimensional (2D) materials have attracted a lot of attention in the last few years since the discovery of graphene. Most of these materials are inorganic solids that form layered structures and are currently the focus of many research group's investigations in the area of

spintronics. In our group we have developed a Van der Waals 2D metal organic framework (2D MOF). In this project, the student will prepare luminescent analogues to this Van der Waals 2D MOF and study the exfoliation of the Van der Waals solid into nanosheets and the magnetic and luminiscent properties of the species formed.

Water soluble Iron oxide nanoparticles for drug delivery

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Websites: GMMF: http://www.gmmf-ub.com and http://www.ub.edu/terapiamol/cancer/

Description of the project:

Iron oxide nanoparticles (NPs) can be readily prepared by well-known methods as monodisperse, crystalline nanoparticles. By controlling the conditions, the major phase in these nanoparticles is the magnetic oxide magnetite, Fe_3O_4. The properties of iron oxide NPs make them excellent candidates for medical applications: Fe is an essential element and iron oxides can be readily metabolized or assimilated by the organism, thus iron oxide NPs lack the toxicity often related to heavy metals. The fact that they are magnetic can be exploited for targeting specific sites in the organism using a magnetic field that is not harmful. A procedure for preparing water soluble iron oxide NP with hyaluronic acid (NP-HA) has been designed in the GMMF

Cancer therapy with PPRH hairpins. PolyPurine Reverse Hoogsteen hairpins are a new kind of gene silencing molecules developed in our laboratory. They consist of two strands of DNA linked by 5 thymidines. Each strand of that DNA is formed by polypurines and bind to each other by Hoogsteen bonds. These hairpins bind to polypyrimidine tracks present in the genomic DNA inhibiting transcription and splicing thus causing a decrease in gene expression. Therefore, this genomic tool can be used to decrease the expression of genes that are overexpressed in certain diseases, such as cancer.

In this project you will work in a multidisciplinary environment. The main goal is a complete a study of the functionalization of NP-HA with a PPRH hairpin in order to obtain hybrid nanoobjects suitable for delivering the hairpin to the target. The final aim is to be able to deliver therapeutic molecules such as PPRHs using Iron oxide NPs for efficient targeted cancer therapy. In the project the student will optimize the synthesis of the hybrid system and assess the toxicity of the delivery vehicle (NP-HA) and of the functionalized system NP-HA-PPRH.