Tuesday 7th November 2017

Polo Scientifico e Tecnologico “F. Ferrari” – Aula A213

Daniel Ortega Ponce
(IMDEA Nanociencia)

Ore 9:00 aula A213

PHYSICS AND CANCER THERAPIES: THE CASE OF MAGNETIC HYPERTHERMIA

ABSTRACT:
Physics is present in many diagnostic and therapeutic techniques in medicine. Magnetism is represented in a number of these, like fetal magnetography, magnetic resonance imaging, magnetic brain stimulation, magnetoencephalography, or magnetocardiography, to name but a few. Among nanotechnology-based therapies, magnetic hyperthermia is potentially the most significant and technically disruptive of the currently known biomedical applications of magnetic nanoparticles. It is based on the heat dissipation by magnetic nanoparticles when subjected to an external alternating magnetic field. Such heat release is exchanged with the particle surrounding leading to a temperature increase that has been shown to efficiently induce cell death when the nanoparticles are located inside the cells. This local “intracellular heating” leads to a more efficient cell death pathway than the “extracellular systemic heating”. Recent developments indicate that this highly specific and targetable method of localised remote heating of bodily tissue could revolutionise clinical practice in the treatment of cancer, either as an adjunct to radiotherapy and chemotherapy, or as a stand-alone intervention. This is exemplified by the outcomes obtained in clinical trials on glioblastoma, bone cancer, or prostate cancer patients. Despite the advances made so far through the last decades, further progress requires a sustained investment of time and resources to see a prompt clinical implementation of magnetic hyperthermia. The present talk provides a current outlook on the technique and some future perspectives.

Ore 10:00 aula A213

TOWARDS IN SILICO CLINICAL TRIALS FOR MAGNETIC HYPERTHERMIA

ABSTRACT:
Computer simulations for functional modelling of biological systems are broadly known as in silico tests. In the mid- and long-term, such forecasting procedure will allow for a noticeable reduction of the animals and humans required for in vivo testing, and more importantly, it will provide a precise tool for guiding clinicians in planning clinical studies of modern therapies like magnetic hyperthermia. After the success in past clinical trials and the hopes in the forthcoming ones, such as that on pancreatic cancer coordinated by the NoCanTher project (www.nocanther-project.eu), computer simulations are becoming essential in treatment planning. Mathematical methods are essential to in silico testing, being present in all the steps of the process: from phantom modelling, to physics solvers and discretisation techniques (for example, voxelization). The present talk intends to showcase the breadth of mathematical methods specifically involved in in silico testing of magnetic hyperthermia, as well as the need for developing improved models and methodologies.

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