



Seminar title: Magnetically driven lab-on-a-chip devices for biomedical applications

Abstract

The use of magnetic micro- and nanomaterials has exponentially grown in the last few decades as a consequence of their superior properties in comparison to their bulk counterparts. Multiple reports about the synthesis and application of magnetic nanoparticles with different functionalities have shown the promising role of these materials in the development of fast and efficient biochemical processes. Moreover, iron is one of the most abundant elements in the universe and an essential trace element for nearly all forms of life. Its presence in cells and proteins allows for the use of label-free magnetic bioseparations. Nevertheless, the safe and reliable manipulation of particles, ferrofluids, and cells with magnetic fields is less explored. The physics of magnetophoresis is still poorly understood, leading to difficulties in the successful integration of these attractive technologies. Here, several magnetically driven lab-on-a-chip devices are presented, and the advantages of magnetic techniques in comparison to other technologies are demonstrated. Particularly, the magnetic devices presented here are able to: i) be integrated into novel treatment methods; ii) perform the synthesis of outstanding biomaterials; and iii) be employed as diagnostic tools for detection of diseases. Moreover, new theoretical approaches and several design guidelines are introduced for facilitating the future development and establishment of these novel technologies.