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**Biomedical Applications of Magnetic Nanoparticles: Delivering Genes and Remote Control of Cells**

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The use of magnetic micro- and nanoparticles for biomedical applications was first proposed in the 1920s as a way to measure the rehological properties of the cell's cytoplasm. Since that time, magnetic micro- and nanoparticle synthesis, coating and bio-functionalization have advanced significantly, as have the applications for these particles. Magnetic micro- and nanoparticles are now used in a variety of biomedical techniques such as targeted drug delivery, MRI contrast enhancement, gene transfection, immno-assay and cell sorting. More recently, magnetic micro- and nanoparticles have been used to investigate and manipulate cellular processes both *in vitro* and *in vivo*. This talk will focus on magnetic nanoparticle targeting to and actuation of cell surface receptors to control cell signaling cascades to control cell behavior. This technology has applications in disease therapy, cell engineering and regenerative medicine. The use of magnetic nanoparticles and oscillating magnet arrays for enhanced gene delivery will also be discussed.