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**The combined magnetic field and iron oxide-PLGA composite particles: Effective protein antigen delivery and immune stimulation in dendritic cells.**

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**ABSTRACT**

Superparamagnetic iron oxide nanoparticles (SPIONs) have received much attention in drug and biomolecule delivery systems. Here, we report a delivery system using the combination of a magnetic field and the relatively biocompatible composite particles of poly(lactic-co-glycolic acid) and SPIONs (SPION-PLGA particles) for protein delivery to bone-marrow derived primary dendritic cells (BM-DCs). SPIONs with the diameter of ~10 nm were synthesized via thermal decomposition of iron(III) oleate. The SPIONs and bovine serum albumin (BSA) were encapsulated in PLGA particles of two different diameters, 300 and 500 nm. The obtained SPIONs-PLGA nanocomposites exhibited superparamagnetic character, showed low cytotoxicity and were well taken up in macrophage and BM-DCs under an external magnetic field. In addition, the nanocomposites were tested for immune induction in BM-DCs. This combined SPION-PLGA carrier and an external magnetic field can significantly enhance BM-DC maturation by upregulating MHC II, CD80 and CD86 expression. Immune response induction by this strategy is verified through a significant upregulation of the IL-12 and IFN- $\gamma$  production. Moreover, no activation of BM-DCs to secrete pro-inflammatory cytokine TNF- $\alpha$  was observed for all particles. We

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