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Effect of magnetic Ni-Pt nanorods rotating inside fibroblast NIH/3T3 cells

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Magnetic NanoRods (NR) have been used inside cells to deform cytoplasm and cellular membrane, and to generate cell death. Cell death has been studied as selective therapy against malign cells. However, the mechanism of action that leads to this kind of death remains unknown. To describe this mechanism, we analyzed cell membrane integrity after being treated with magnetic NRs that rotate at low frequency and NRs effect on cell proliferation rate. To do this, we fabricated Ni-Pt NRs by electrodeposition into porous alumina templates, being one of the first studies that analyze Pt particles of this size inside any kind of cells. We designed a low frequency Magnetic Field (MF) generation system with temperature control to allow NRs to rotate inside cells avoiding thermal stress. We incorporate NRs to fibroblast NIH/3T3 cell culture and after one-day MF was applied. Membrane integrity was identified by specific dye 20 minutes after treatment. We confirmed NR incorporation by a microscopy video of a single NR rotating inside a single cell and bouncing against its membrane. Membrane integrity damage was only found in cells treated simultaneously with NRs and MF, thus cell death mechanism is necrotic-like since apoptosis needs more time to occur. Proliferation inhibition was observed on cultures with NRs, indicating that particles alter cell cycle and needs to be functionalized to be biocompatible. This will allow us to understand the effect of NRs on cell death.

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