

New therapies for cancer based on intracellular nanostructures

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Magnetic hyperthermia (MHT) is a clinically-approved oncological therapy that generates heat from the intracellular space by the use of magnetic nanoparticles under ac magnetic fields. A key question is whether intracellular heating could imply local apoptotic mechanisms that are more efficient than exogenous heating (EHT). We have addressed this question by systematic comparison of MHT and EHT experiments with the same conditions and target temperatures. Human neuroblastoma SH-SY5Y cells were co-cultivated with magnetic nanoparticles (MNPs) and conditioned as dense pellets to mimic a micro-tumor environment. We found that MHT was able to induce cell death levels larger than the corresponding EHT for the same target temperatures. In terms of thermal efficiency, MHT requires an average temperature that is 6°C lower than that required with EHT to produce a similar cytotoxic effect. Also, cell morphologies show higher level of cell damage when MHT is applied. These differences were associated to the intracellular action of the magnetic nanoparticles, triggered by the local release of heat by the external magnetic fields.