Magnetic Nanomaterials as a Multifunctional Platform for Cancer Treatment

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Innovative approaches to cancer treatment require research into cutting-edge strategies, including nanotechnology. Magnetic nanomaterials, with their tunable physicochemical properties, represent a promising theranostic platform for personalized therapies. Among the various nanomaterials, superparamagnetic particles and their composites are particularly characterized by their ease of production, their surface functionalization with therapeutics (e.g. photoactive molecules, cancer drugs) and the possibility of tracking them using magnetic resonance imaging (MRI). In addition, these materials can generate local heat when exposed to an external magnetic field when required, allowing applications in hyperthermic treatments. Magnetic nanomaterials can also be integrated into various matrices, such as wound dressings and tissue regeneration scaffolds, to increase their therapeutic potential. Their defined magnetic properties improve the precision of drug delivery and enable controlled heat generation. Crucially, functionalizing magnetic nanomaterials with organic molecules increases their colloidal stability, minimizes aggregation in biological tissues, and enables drug release regulation in certain environments. Depending on the functional coating, these nanocarriers can combine localized drug delivery with photodynamic therapy and hypoxia mitigation, providing a multifunctional approach that improves therapeutic efficacy while minimizing side effects. The remarkable precision and adaptability of magnetic nanomaterials positions them at the forefront of advanced cancer research and clinical applications, paving the way for highly efficient and targeted treatments. In this talk, we will discuss the latest results of our investigation of multifunctional nanoparticles in cancer treatment.

Reference:

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