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Synthesis of a polymer-magnetic particle platform for "tailored" multimodal materials for imaging and treatment

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Magnetic nanoparticles have been studied for many years for use in biomedicine, not only for their high surface area, but also because of its unique magnetic properties. This presentation will describe the synthesis of a multi-anchored universal ligand for iron oxide nanoparticles, with improved stability in biological environments, while also providing a platform for additional functionality. The particles reported in this talk were modified with a heterobifunctioal polyethylene oxide (PEO) with an terminal end capable of "click" chemistry and nitroDOPA anchors to provide strong binding to the surface and used in a mulitdentate approach provides biocompatibility and enhanced stability in fetal bovine serum and phosphate buffer saline. For demonstration purposes, these colloidally stable biocompatible polymer-particles complexes were then be modified with a near-infrared dyes (e.g. Cy5) In addition to imaging, we have also utilized the same platform for the targeting of di fferent strains of bacteria through "clicking" on species-specific moieties. The modified particles adhere to the targeted bacteria strains and agglomerate. Through the application of an alternating field, magnetic energy can be transformed to promote cellular death, resulting in a multi-log reduction in bacteria population. What will be presented represents the initial findings of the research opportunities available with this new platform for diagnostic and therapeutic applications. These universal magnetic nanoparticles can be modified with different fluorescent dyes imaging biofilms, carbohydrates for targeting bacteria, and other moieties for multifunctional diagnostic probes to show the versatility of this design.