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## **Recent advances of magnetic gold hybrids and nanocomposites, and their potential biological applications**

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**M**agnetic Gold Nanoparticles (mGNP) have become a great interest of research for nanomaterial scientists because of their significant magnetic and plasmonic properties applicable in biomedical applications. Various synthetic approaches and surface modification techniques have been used for mGNP including the most common being the co-precipitation, thermal decomposition, and micro emulsion methods in addition to the Brust Schiffrin technique, which involves the reduction of metal precursors in a two-phase system (water and toluene) in the presence of alkanethiol. The hybrid magnetic-plasmonic nanoparticles based on iron core and gold shell are being considered as potential theranostic agents. In this critical review, in addition to future works, we have summarized recent developments for synthesis and surface modification of mGNP with their applications in modern biomedical science such as drug and gene delivery, bioimaging, biosensing, and neuro-regeneration, neuro-degenerative and arthritic disorders. I shall discuss the techniques and biological applications of mGNP majorly based on my own research.

**Keywords:** Nano hybrids, Magnetic gold nanoparticles, Nano composites, Surface functionalization, Core-shell nano composites, Magnetic-plasmonic nanoparticles, Biological applications.