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Sommario/riassunto	The selective and quantitative detection of biocomponents is greatly requested in biomedical applications and clinical diagnostics. Many traditional magnetic materials are not suitable for the ever-increasing demands of these processes. The push for a new generation of microscale sensors for bioapplications continues to challenge the materials science community to develop novel nanostructures that are suitable for such purposes. The principal requirements of a new generation of nanomaterials for sensor applications are based on well-known demands: high sensitivity, small size, low power consumption, stability, quick response, resistance to aggressive media, low price, and easy operation by nonskilled personnel. There are different types of magnetic effects capable of creating sensors for biology, medicine, and drug delivery, including magnetoresistance, spin valves, Hall and inductive effects, and giant magnetoimpedance. The present goal is to design nanomaterials both for magnetic markers and sensitive elements as synergetic pairs working in one device with adjusted characteristics of both materials. Synthetic approaches using the advantages of simulation methods and synthetic materials mimicking natural tissue properties can be useful, as can the further development of modeling strategies for magnetic nanostructures.