

Nanomedicine: Towards the “Magic Bullet” Science

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A century ago, Paul Ehrlich imagined the concept of selectively target a pathogen without affecting the host using the “magic bullet”. Since twenty years, researchers in cancer therapy were particularly inspired by the idea. The engineering of tiny systems to detect, diagnose and treat disease gave rise to the most promising advances in the fight against cancer, the nanomedicine.

Before becoming an extraordinary fruitful market, nanotechnology was a crazy idea in the mind of science fiction writers. In the 1966 movie *Fantastic Voyage*, a team of researchers is reduced and injected into the blood stream. This movie became a wonderful tool in medical schools to illustrate the concept of immunology.

Today, researchers around the world are putting no end energy in the elaboration of nanomachines enable to accomplish into one single system a large number of tasks, going from diagnostic, imaging to healing cells including nano-surgery.

Nanomedicine presents tremendous potential for improving cancer treatment leading to numerous drug delivery platforms. While nanosystems such as liposomes and polymer micelles have considerably improved delivery of chemotherapeutics, several biological barriers limit drugs antitumor efficacy. Chemotherapy is a powerful adjuvant therapy; however the ability to target large amounts of drugs site-

specifically remains a challenge. Both issues can be solved using an innovative cutting-edge approach to controlled drug delivery which lies in magnetic nanoparticles. They can be ‘remote-controlled’ via magnetic fields to target precisely a location inside the human body. Another current trend in targeting tumors at the nanoscale is to functionalize the nanomachines with moieties that can recognize tumors and then enhance site-specific delivery.

Preclinical trials initiated with nanomaterials showed that nanoparticles are safer and more effective in imaging and delivering drugs than current clinical treatments. They enable to specifically target tumors while cautiously preserving surrounding healthy tissue. In addition, nanotechnology has significantly improved the sensitivity of magnetic resonance imaging, allowing easy detection of hard-to-find cancers.

Potent anti-cancer drugs are in higher demand than ever before. The future of nanomedicine will therefore consolidate diagnosis and targeted therapy into a single, centralized system of treatment. This novel ‘theranostic’ strategy will have the potential to pave the way for treatment of cancer in a highly selective and effective, yet relatively sensitive, manner and will surely result in the personalization of chemotherapy for improved patient outcomes.

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