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Hermis Iatrou*

Department of Chemistry, University Of Athens, Greece

***Corresponding author:** Prof. Hermis Iatrou, University of Athens, Director of the Graduate Student Program, Director of the in the Chemistry Department, Greece, Tel: +302107274440, Fax: +302107221800, Email: iatrou@chem.uoa.gr

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Editorial

Recently, the explosion of progress in the science and engineering of materials at the Nano scale level has paved the way for a new category of healthcare technologies generally termed Nano medicine. Nano medicine involves manipulating, engineering, and exploiting different material properties at the nanometer level to design products that can improve the currently used technologies for biomedical applications. While traditional therapeutic agents have allowed for very little control in terms of their distribution in the body and clearing times, engineering at the Nano scale level has allowed for significant advances in optimizing the biocompatibility, bio distribution and pharmacokinetics of various medical technologies. Among the materials used to design and produce therapeutics for Nano medicine applications, polymeric materials have dominated the Nano-medicine world. This is due to their high functionality and the possibility to manipulate their properties by combining different materials in a wide variety of macromolecular architectures. Such architectures that eventually direct the self-organization of the materials into nanostructures that possesses the desired properties for effective drug/gene encapsulation as well as selective and controlled delivery. The development of novel polymeric materials is guided by the goal of improving patient survival and quality of life by increasing the bioavailability of drug to the site of disease, targeting delivery to the pathological tissues, increasing drug solubility, and minimizing systemic side effects. The materials presented to date to achieve these goals are either nanoparticles for systemic administration, or hydrogels for local delivery. In case of cancer treatment, the nanomaterial's locate their target either by passive or by active targeting, by conjugation of a chemical moiety that is overexpressed in cancer cells, by introducing stimuli-responsive triggering for the release of the payload under environmental conditions that can be found only in cancer tissues, or by the combination of all the above methods.

Over the last 40 years, tremendous advancements towards the discovery of novel drugs as well as drug delivery systems have been reported. The evolution of drug delivery systems resulted in the development of novel materials with high specificity for controlled delivery. Drugs are selectively delivered to the targeted cells in a defined dose with minimum side effects. As a consequence, the development of novel molecules in combination with multifunctional delivery Nano carriers resulted in highly lethal diseases becoming chronic or even completely curable. For instance, in the past the HIV and hepatitis C viruses both caused highly lethal diseases, but today AIDS is now a chronic disease and hepatitis C has been cured, thanks to the development of novel and more efficient drugs. Amongst more than 200 different cancers some, such as melanoma, are also now chronic diseases due to novel carrier systems for known pharmaceuticals.

In complex diseases such as cancer, very sophisticated Nano carriers should be designed to encapsulate a significant quantity of drugs, to bypass biological barriers with minimum cargo loss and effective and selective delivery to the desired pathological site. The collaboration of material as well as pharmaceutical scientists, biologists and clinical oncologists is imperative to produce efficient materials that possess advanced properties and required functionalities. Novel theories on cancer evolution and a better understanding of the biology of diseases have already provided insight into the cause of disease and its treatment. Furthermore, in our opinion, advancements in drug design and the development of multifunctional Nano carriers from the combination of well-defined macromolecular architectures and smart materials are the future for the effective treatment of many lethal diseases.