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Multifunctional magnetic nanocarriers of anticancer drugs

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Magnetic nanoparticles have been intensively investigated for the selective delivery of anticancer agents. Magnetic drug nanocarriers provide further advantages as they concomitantly allow for tissue imaging through magnetic resonance imaging and can induce cell-destructive hyperthermia in tumor by application of external alternating magnetic fields. We have been investigated the application of hybrid organic/inorganic magnetic nanoparticles for a more selective delivery of potent anticancer agents to tumors. In this context, we developed recently pH-responsive magnetic nanocarriers based on the graft-copolymer of poly (methacrylic acid)-g-poly(ethyleneglycol methacrylate) for the controlled delivery of cisplatin. Enhanced *in vivo* anticancer therapeutic efficacy and reduced toxicity was recorded for these cisplatin nanocarriers in comparison to the free drug cisplatin, particularly when a magnetic field gradient was applied at the tumor site. A problem frequently encountered with drug nanocarriers is their low level of uptake by tumor cells. In order to overcome this problem, we have developed poly(lactide)-poly(ethyleneglycol) magnetic nanocapsules functionalized with a cell penetrating TAT peptide and loaded them with paclitaxel. The conjugation of the TAT peptide on the surface of the nanocapsules resulted to highly increased uptake of nanocapsules by A549 cancer cells and to a profound improvement of the cytotoxicity of the paclitaxel-loaded nanocapsules against the cancer cells. In order to increase magnetic responsiveness, we developed colloidal clusters of iron oxide nanocrystals (MIONs), particularly in the condensed pattern (co-CNCs). These MION-based co-CNCs were characterized by high magnetization and high relaxivities combined with remarkable colloidal stability and drug-loading properties. Hypoxia develops in solid tumors, which leads to the development of resistance of tumor cells to radiotherapy and chemotherapy. We are working on magnetic nanocarriers for the targeted (selective) delivery of sodium-glucose transporter protein inhibitors to tumors. This nanomedicine combined with radiotherapy or chemotherapy would represent an effective treatment of hypoxic tumors.

Biography

Konstantinos Avgoustakis obtained his Diploma in Pharmacy from Aristotle University of Thessaloniki, Greece in 1985 and a PhD degree in Pharmaceutical Technology from King's College, University of London, UK. Since 1994, he has joined the Department of Pharmacy in University of Patras (Greece), where he teaches subjects related to Pharmaceutics and Drug Delivery and since 2015 he has joined Biomedical Research Foundation of Athens Academy as Collaborating Researcher. His research interests lie on the controlled, targeted therapeutics delivery using engineered nanoparticles. He is the author of 60 articles in peer-reviewed journals and 1 article in *Biomaterials Encyclopedia*. He is also the author (inventor) of 1 European patent. His published research has received over 2000 citations with an h-index of 23. He is an Assistant Editor of the scientific journal *Current Nanoscience*. He has participated in several research programs in collaboration with academic and industrial organizations (in 7 as coordinator).

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