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Smart polymeric nanoparticles for the delivery of drugs in the BNCT of brain tumors

Anis Daou

Kingston University, UK

Drug delivery through the BBB represents a significant challenge in transporting drugs into the brain, leading to few effective treatments for brain related ailments. Despite the existence of strategies to circumvent the BBB, nanotechnology offers unprecedented opportunities for combining selective delivery, improved bioavailability, drug protection and an enhanced pharmacokinetics profiles. Polymer based nano-carriers allow for a more efficacious drug targeting strategy at cellular and sub-cellular level, and beyond challenging physiological barriers such as the BBB. Moreover, Boron Neutron Capture Therapy (BNCT) is a targeted chemo-radiotherapeutic technique that allows the selective depletion of cancer cells by means of selective tagging of cancer cells with ^{10}B followed by irradiation with low-energy neutrons. Consequently, the combination of a polymer based nano-delivery system enclosing an effective BNCT pharmacophore can potentially lead to the selective delivery of the load to cancer cells beyond the BBB. In this work, a novel ^{10}B -rich agent, based on carborane functionalized with delocalized lipophilic cations which target selectively the mitochondria of tumor cells, was synthesized. The treatment of tumor and cancer stem cells indicated this agent induces selective and permanent cancer cells growth arrest. The drug was then encapsulated in nano-carriers constituted by chitosan nano-shells to improve BBB permeability. Also in combination with poly-pyrrole, these form a smart composite nano-shell of reduced size. The outcomes of release studies and preliminary cell work indicate these strategies hold a great potential for successfully delivering therapeutic amounts of ^{10}B -containing pharmacophore in a selective fashion to cancer cells beyond the BBB.

Biography

Anis Daou is currently pursuing his PhD from Kingston University, supervised by Dr. Giapiero Calabrese. His background is focused on formulation and advanced drug delivery systems. He has published two articles to date in his short research career.

anis_daou@hotmail.com

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