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Esmail Jabbari

University of South Carolina, USA

Nanomaterials for drug targeting to cancer stem cells

A major contributing factor to mortality in cancer patients is relapse after surgery and targeted therapy, and developing resistance to therapy. Breast cancer recurrence affects 30% of the patients. Cancer recurrence and resistance is related to the existence of a very small population of initiating cells or stem cells (CSCs) in the tumor tissue with high expression of ATP-binding cassette (ABC) transporter proteins associated with drug resistance. After therapy, the bulk of tumor shrinks to <1% of its initial volume and the tumor tissue becomes enriched with CSCs that are highly resistant to conventional therapies. Further, as much as 40% of the volume of solid tumors is occupied by tumor-associated macrophages (TAMs), specifically immunosuppressive M2-macrophages, which play a central role in cancer progression. One approach to overcome carrier-mediated drug resistance in CSCs is to use nanoparticles (NPs) for drug encapsulation and intracellular delivery by endocytosis. Unlike drug molecules in which their uptake is affected by up-regulation of ABC transporter proteins, NPs utilize macropinocytosis, clathrin- and caveolin-mediated endocytosis for transcellular cell uptake. Although the uptake of NPs by the mononuclear phagocyte system (MPS) and NPs' enhanced permeation and retention in the tumor tissue is extensively investigated, little is known about the role of TAMs on uptake and toxicity of drug-loaded NPs toward CSC sub-population of cancer cells. I will present experimental results related to the effect of macrophages on toxicity of drug conjugated to polyhedral oligosilsesquioxane (POSS) NPs toward breast cancer cells within a novel three-dimensional CSC-enriching culture system.

Biography

Esmail Jabbari has completed his PhD in Chemical Engineering from Purdue University. He is Tenured Full Professor of Chemical and Biomedical Engineering at the University of South Carolina. His biomaterials, tissue engineering, and drug delivery laboratory specializes in creation of 3D tissue models for skeletal tissue engineering and cancer drug delivery. He is the Author of >260 research articles. He has received Berton Rahn Award from AO Foundation and Stephen Milam Award from Oral and Maxillofacial Surgery Foundation. He was elected to the College of Fellows of AIMBE in 2013. He serves as Academic Editor for *PLOS ONE*.

jabbari@cec.sc.edu

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