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'Smart' Drug Delivery Systems for the Treatment of Cancer

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Conventional chemotherapies targeting tumor suffer from limitations such as poor aqueous solubility, causing elevated toxicity, lack of selectivity toward cancer cells and multiple drug resistance against treatments. This presentation will discuss the development of 'smart' drug delivery systems for the treatment of cancer. Here, we engineered drug carrier systems with three delivery strategies that allow drug carriers to initiate the enhanced permeability and retention (EPR) effects at tumor sites, actively and specifically targeting cancer cells with prolonged circulation time and controlled drug release and thirdly, stimuli-responsive drug carriers. Firstly, the metronomic therapy of a slow-released oseltamivir phosphate (OP) encapsulated in a biodegradable poly (lactic-co-glycolic acid) (PLGA-OP) cylinder implanted at the tumor site without the need for repeated drug administration impeded tumor neovascularization, growth and metastasis in heterotopic xenografts of tumors growing in a mouse model of human pancreatic cancer (*Drug Design, Development and Therapy 2015:9 4573–4586*). Secondly, OP-conjugated polymeric micelles prepared by RAFT living radical polymerization specifically targeted and halted tumor growth followed with the cancer cell internalization of the micelle loaded with a cytotoxic chemotherapeutic (*Biomater. Sci., 2016, 4, 511*). Thirdly, a pH-responsive, active targeting delivery system was designed using folic acid functionalized amphiphilic alternating copolymer poly (styrene-alt-maleic anhydride) (FA-DABA-SMA) via a biodegradable linker 2,4-diaminobutyric acid (DABA) (*Drug Design, Development and Therapy 2016:10 4101–4110; Nanomaterials 2018, 8, 588*). This latter study revealed that the novel interactions between the modified FA-DABA-SMA polymers with the cells could lead to enhanced hydrophobic drug delivery efficiency as a probe for cancer chemotherapeutics. Lastly, we fabricated and characterized Pickering water-in-oil emulsions as a reservoir delivery platform for the sustained release of low molecular weight hydrophilic therapeutic molecules disabling human pancreatic cancer cell survival (*Oncotarget 2018, Vol. 9, (No. 16), pp: 12754-12768*).

Biography:

Dr. Szewczuk is Full Professor of Immunology and Medicine for over 38 years at Queen's University, Kingston, Ontario Canada. Dr. Szewczuk's research has focused on the role of glycosylation in receptor activation with a particular focus of Toll-like, neurotrophin Trk, EGFR and insulin receptors. A novel receptor-signalling platform was discovered and its targeted translation in multistage tumorigenesis. He is now in the development of engineered drug delivery systems.