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Research Focus: Image Guided Drug Delivery

Cancer chemotherapy employs systemic delivery of antitumor drugs with limited specificity, causing toxic side effects in normal tissues and inefficient/insufficient drug delivery to tumor cells that leads to recurrence. To address these problems, liposomal stealth drug delivery systems (e.g. Doxil) have been developed to selectively accumulate tumors, permitting enhanced intratumoral drug delivery while reducing drug exposure and toxicity to normal tissue. However, available clinically-approved nanocarriers release their payload only within the perivascular space of tumors, impeding or preventing distribution to poorly-perfused remote cells in the tumor core that contribute to drug resistance and tumor recurrence. Thus the tumor-directed dose escalations achieved to date via stealth liposome technology have not yet improved treatment efficacy. To overcome these limitations, the long-term goal of our laboratory is to optimize and provide uniform intratumoral delivery of antitumor drugs with real-time control, thereby providing clinical more precise dosing control. Ongoing projects are focused on development of drug encapsulated thermosensitive nanocarriers that can achieve homogeneous, tightly-controlled intratumoral delivery of antineoplastic drugs. Parallel efforts are centered on utilizing thermoregulatory-mediated elevations of blood flow in vascular beds proximal and distal to the tumor vasculature under image guidance that may improve blood flow through the tumor, perhaps in part by drawing excess fluid from tumor stroma and thereby relieving interstitial pressure, and decompressing tumor vasculature.

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