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Photoswitchable Nanoparticles for Triggered Drug Delivery

By

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Controlled release technology is expected to have a profound impact in many medical fields including oncology. The incorporation of chemotherapeutic agents in nanoparticle delivery vehicles has improved drug solubility, reduced clearance, reduced drug resistance and enhanced therapeutic effectiveness. With controlled release nanoparticle systems, a single dose can sustain drug levels within the desired therapeutic range for long periods in various diseases (e.g., diabetes or cancer). However, currently approved nanomedicines provide modest survival benefits for patients, in part because of poor tumor penetration. In fact, physiological barriers, such as the dense interstitial matrix, hinder the delivery of drugs throughout the entire tumor. Another significant drawback of commercially available drug delivery particles is that drugs are released at a predetermined rate irrespective of patient needs or changing physiological circumstances. A triggerable drug delivery system that allows repeated on-demand dosing and multiple dosages from a single administration is thus desirable. It might also help address the potential importance of timing on therapeutic effect in the treatment of cancer and other diseases.

In this talk, I will present a photo-switching nanoparticulate system that uses light as the remote means of triggering both on-demand drug release and reversible changes in particle volume (from 130 to 40 nm) to enhance tissue penetration. The photo-switching allows particles to fluoresce and release drugs inside cells when illuminated with light. These particles provide spatio-temporal control of drug release and enhanced tissue penetration, useful properties in many disease states including cancer and ocular diseases. For the first time, the remotely light-triggered nanoparticulate drug delivery system shows preclinical benefits that enables repetitive dosing from a single administration with improved delivery efficacy throughout tumors.

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