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Preparation and characterization of lipid nanoparticles containing photodynamic therapy drugs

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Cancer nanomedicine is a promising area for improved drug delivery. Our objective is to develop light-sensitive liposomes (lipid bilayer nanoparticles) that will allow for drug release at the desired site in patients. Photo-triggerable liposomes containing the photodynamic therapy (PDT) molecule HPPH and calcein (a water-soluble fluorescence molecule), have been demonstrated as suitable light-sensitive nanoparticles. In this study, we have tested Chlorine 6 (Ce6), a PDT molecule that differs from HPPH in its structure but has a similar absorption spectrum. We examined the ability of Ce6 to package into the liposomes and its effect on the efficiency of calcein loading. The liposomes were tested for laser-triggered calcein release and Ce6 photo-damage. Our data shows that: (1) Ce6 incorporates in the liposomes with similar efficiency to that of HPPH, (2) Calcein can be loaded into Ce6-containing liposomes with similar efficiency, (3) The liposomes range from 80-110 nm hydrodynamic diameters and (4) Upon laser treatment, photo-damage of Ce6 occurs, however, calcein release is less than that of HPPH-loaded liposomes. Therefore, our data alludes to specific drug-lipid interaction requirements for optimal drug release from the liposomes. Our studies will aid in future clinical applications for localized delivery of multiple drugs.

Recent Publications

1. A Puri, K Loomis, B Smith, J H Lee, A Yavlovich, E Heldman and R Blumenthal (2009) Lipid-based nanoparticles as pharmaceutical drug carriers: from concepts to clinic. *Crit Rev Ther Drug Carrier Syst.*; 26: 523-580.

2. A Puri (2014) Photo-triggerable Liposomes: Current Research and Future Perspectives. *Pharmaceutics;* 6: 1-15.

3. M Viard and A Puri (2015) Stimuli-Sensitive Liposomes: Lipids as Gateways for Cargo Release. In: Ales Iglic, Chandrashekhar V Kulkarni and Michael Rappolt, editors. *Advances in Planar Lipid Bilayers and Liposomes*; 22: 1-41.

4. J Sine, Urban C, Thayer D, Charron H , Valim N, Tata D B, Schiff R, Blumenthal R, Joshi A, Puri A Photo (2015) Activation of HPPH Encapsulated in "Pocket" Liposomes Triggers Multiple Drug Release and Tumor Cell Killing in Mouse Breast Cancer Xenografts. Inter. *J. Nanomed.;* 10: 125-145.

5.Photoactivable Lipid-based Nanoparticles as Vehicles for Dual Agent Delivery (U.S. *Patent Application No.* 14/904,385).

Biography

Eshaan Soman is currently a student in the 12th grade at Hillsborough High School, New Jersey. Prior to his Internship at the National Cancer Institute, he has conducted research at various other institutions such as New York University and Princeton University. He has recently been selected as a Governor's STEM Scholar, has published an article in the National High School Journal of Science.

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