Structural Optimization of Lipid-Based Nanocarriers to Improve Targeted Codelivery of Curcumin and siRNA-Based Cancer Treatments

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Lipid nanoparticles (LNPs) are FDA-approved tools for delivering small-molecule drugs and nucleic acids for cancer treatments with extensive ability to improve drug targeting and efficacy. LNPs have been studied in the context of curcumin, a hydrophobic compound with anticancer and chemosensitizing properties, and siRNA, a nucleic acid, which can silence oncogenes and resistance pathways. Effective co-delivery of these two drugs has significant potential to simultaneously modulate signaling pathways while blocking pathogenic gene expression, while also remaining non-toxic to healthy cells. However, curcumin and siRNA occupy different regions within LNPs, so creating cohesive, useful LNP co-delivery drugs has been a major challenge in established literature. This study investigates how specific lipid subcomponents, utilized in varying combinations and concentrations, impact encapsulation efficiency, stability, surface charge, and 24-hour release profiles of curcumin and siRNA individually or as a co-loaded cargo. I will also test the effect of environmental conditions on LNP size, zeta potential, and cargo retention. This study provides a compositional "map" of structured lipid subcomponents that could be deployed in future translational studies to improve and accelerate cancer treatments.

Awards Won: