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Assembling a Dextran-Based Nanoparticle Platform for Uptake by Cancerous Cells

Current cancer treatment methods, such as chemotherapy and radiation, result in the unwanted death of both healthy and cancerous cells. A method that uses nanocarriers as an actively targeted drug delivery system is currently being investigated. The nanocarrier must encapsulate and carry a drug, pass biological barriers, release the drug at a sustained rate, and kill the cancerous cells. The development of a versatile nanocarrier platform that can encapsulate a variety of drugs has proven to be a formidable challenge.

In this study, a novel dextran-based (type of sugar molecule) nanoparticle platform was developed to encapsulate rhodamine and fluoroscien isothiocyanate (FITC), which acted as model drugs. Using click chemistry, lipid-, thiol-, and poly(ethyleneglycol)-conjugated dextran molecules were synthesized. Structures were confirmed by 1H-NMR spectroscopy, and dynamic light scattering in the Zetasizer instrument determined nanocarrier size.

The nanocarrier platform successfully encapsulated fluorescent dyes with varying hydrophobicities. These dextran nanocarriers were tested on pancreatic cancer cells to determine the nanoparticle efficiency and cellular uptake. Microscopy showed that using nanocarriers resulted in a significantly higher cellular uptake by the cancerous cells compared to the free dye.

The overall goal and continuing research for this project involves creating a combinatorial library of nanocarrier systems to determine which platform is the most efficient drug delivery vehicle. The dextran-based nanocarrier platform developed in this research is a promising alternative to current, conventional drug delivery methods.