CANCER PREVENTION & RESEARCH INSTITUTE OF TEXAS

Award ID:
RP180827

Project Title:
Polymer Nanodiscs: Novel Lipoprotein-Mimicking Nanocarriers With High Stability and Long Circulation Time for Enhanced Anticancer Drug Delivery

Award Mechanism:
High Impact/High Risk

Principal Investigator:
Liang, Hongjun

Entity:
Texas Tech University Health Sciences Center

Lay Summary:

Because most anticancer drugs are highly toxic and dissolve poorly in water, their controlled delivery across aqueous physiological pathways with desirable dosage and specificity to tumor cells is an extraordinary challenge that remains largely unsolved. Nanotechnology has been widely anticipated to benefit cancer therapy because a unique character of tumors is their “leaky” vessels, i.e. cancer cells are poorly aligned to create nanoscopic pores (one nanometer is one ten thousandth of the width of a typical human hair). As such, drug-loaded nanocarriers with the right sizes accumulate preferentially at the tumor sites. Despite decades of active efforts, translational progress is still few and far between because a multitude of biological barriers are involved. Besides the size control, the shape and surface chemistry of the nanocarriers, the active cancer targeting ligands, the payload capacity and stability during circulation, and the cancer-responsive drug release mechanisms are all important design criteria that need work together to address the different aspects of the biological barriers. Most existing nano-platforms only address one or few aspects of that without even optimizing their sizes. Instead of testing all sorts of nano-platforms in an Edisonian approach, we propose to start with a good candidate that has the desirable size first, then work our way up in a systematic manner to address the multifaceted biological barriers simultaneously. Our recently discovered polymer nanodisc (PND) is such an unusually promising nano-platform. It has the desirable size and versatile chemical malleability to address many aspects of biological barriers concurrently. This proposal aims to produce proof-of-concept data on rationally designed PNDs to direct their future development as nanocarriers for cancer therapy. If successful, it will help the clinical translation of many anticancer drugs to treat a variety of cancers with significantly improved patient responses.