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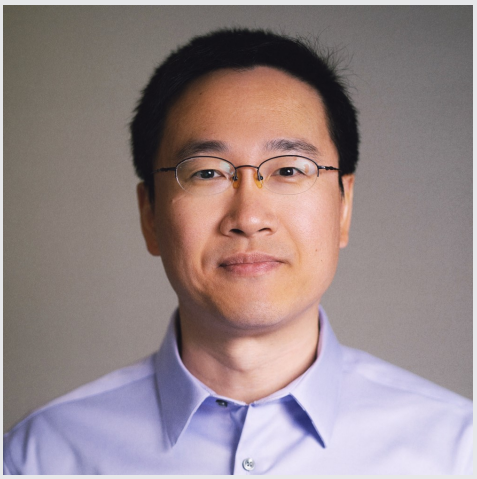
"Ultra-long circulating nanomedicines and therapeutic proteins"

Dr. Hao Cheng, Ph.D.



Dr. Hao Cheng is an Associate Professor in the Department of Materials Science & Engineering at Drexel University. He received his B.E. and M.S. degrees in Chemical Engineering from Tsinghua University and his Ph.D. in Materials Science & Engineering from Northwestern University. Prior to joining Drexel University, he was a postdoctoral associate at Northwestern University and MIT. His laboratory focuses on cell membrane-derived hydrogels, long circulating nanoparticles, and biomaterials for inducing antigen-specific immune tolerance. As a corresponding author, Dr. Cheng has published in journals such as ACS Nano, Advanced Materials, Nano Letters, and Nature Communications. He is a recipient of the inaugural Nano Research Young Innovators Award in Nanobiotechnology and an Editorial board member of the journal, Bioactive Materials.

The efficacy of nearly all nanomedicines and some therapeutic proteins are limited by their short circulation in the blood. We have found that the blood circulation time of nanoparticles could be dramatically extended by controlling the dynamic topographical structure of polyethylene glycol (PEG) shell on nanoparticles, whereas conventional high density PEG shell does not have this effect. Surprisingly, the dynamic effect extends nanoparticle circulation via reduced nanoparticle uptake by liver sinusoidal endothelial cells instead of macrophages. Although PEG is broadly used for extending therapeutic circulation, anti-PEG antibodies in the body expedite the clearance of PEGylated therapeutics and may cause allergic reactions as well when PEGylated therapeutics are administered. We have synthesized zwitterionic PEG (ZPEG), combining the advantages of flexible PEG and zwitterionic polymers. ZPEG conjugation extends uricase circulation half-life from 10 to 100 hours in mice, and the circulation is not affected by anti-uricase antibodies after immunization. Unlike PEG-uricase, repeated doses of ZPEG-uricase do not induce anti-polymer antibodies. The ultra long circulation of ZPEG-proteins and low immunogenicity of ZPEG indicate that ZPEG is potentially superior to PEG for therapeutic delivery.

DATE: January 23, 2025 at 3:30 p.m.

LOCATION: 111 Rhodes Annex, Clemson University
(Zoom link available for all locations.)

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