

Neutrophil-Mediated Transendothelial Delivery of E-selectin Liposomes for Targeting Inflammatory Sites

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Abstract

Nanomedicine is an expanding field that is revolutionizing translational medicine. Among the various nanoscale carriers, liposomal nanoparticles have gained significant attention due to their ideal size for robust transport within the environment of the body. Cell-mediated drug delivery harnesses the unique capability of nanoparticles to transport therapeutic cargo to specific destinations, such as tumors or inflamed tissues. To exploit this potential, our laboratory has developed a strategy for conjugating the protein E-selectin (ES) to the lipid-PEG shell of liposomes. This approach is advantageous as white blood cells possess ES ligands on their surface, enabling effective attachment of the liposomes to these cells. Subsequently, the liposomes can hitch a ride with white blood cells to target cancer cells in circulation or reach inflammatory sites, leveraging the immune system's natural response. Our investigation has focused on neutrophils as carriers for this cell-mediated delivery method, given their role as the body's first responders to infection or injury. By utilizing the protein Interleukin-8 (IL-8) as a signaling mechanism, we have successfully guided neutrophils to specific locations. Through comprehensive experimentation using TransWell™ migration chambers and identification through confocal imaging, we have demonstrated the ability of liposomes to attach to neutrophils and facilitate their migration across endothelial-like barriers via IL-8 signaling. These findings highlight the potential of liposome-neutrophil conjugates as efficient drug-carrying nanoparticle carriers, offering rapid and targeted relief in various medical conditions.

Biography of Presenter

Laura Weinstein is a Eugene du Pont Scholar in the Honors College at the University of Delaware where she is studying biomedical engineering and nanoscale materials. At her home university, Laura is an undergraduate researcher in the Day Lab, where she researches polymeric nanoparticle synthesis for biomimetic cargo delivery. She presented her first poster in 2022 at the University of Delaware Summer Scholars Symposium as a part of the Center for Biomechanical Engineering Research (CBER) REU, and gave an oral presentation on her research as a Winter Research Fellow in January 2023. During her time at UD Laura has won the 2022 Ratcliffe Eco Entrepreneurship Foundation Switch Pitch and Innovation Sprint, 2022 and 2023 National Cyber Scholarship, and in 2023 was awarded the Biomedical Engineering Distinguished Sophomore Award. Aside from academia, Laura is also the night manager of a local bakery, a Programming Senator within the student government, and the founder and treasurer of UD's first non-profit book club aimed at bringing free books to the Newark community. This summer Laura is grateful to be a part of the Vanderbilt Institute for Nanoscale Science and Engineering (VINSE) REU at the King Lab where she is researching cell-mediated drug delivery. After her graduation from UD, Laura plans to earn a PhD in bioengineering with a focus on nanomedicine and drug delivery.

