UC San Diego
JACOBS SCHOOL OF ENGINEERING
Aiiso Yufeng Li Family Department of Chemical and Nano Engineering

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DISTINGUISHED SEMINAR

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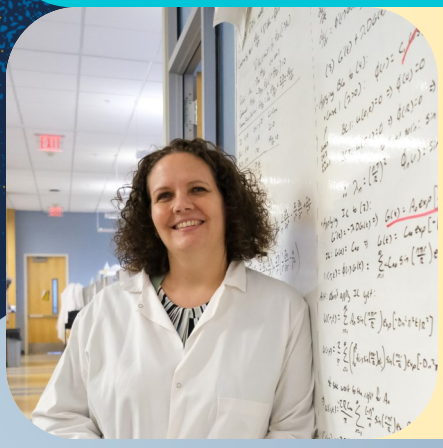
SME 248



Dr. Kristy Ainslie, PhD

"From Bench to Brain: Translating Nanofiber Drug Delivery for Glioblastoma Therapy"

Eshelman Distinguished Professor
Pharmacoengineering and Molicular Pharmaceutics
UNC Eshelman School of Pharmacy

Abstract: Glioblastoma (GBM) remains a highly aggressive brain cancer with poor prognosis, in part due to the limitations of systemic therapies crossing the blood–brain barrier and the recurrence of tumors postresection. Interstitial drug delivery offers a promising alternative, yet current approaches often lack optimal control over therapeutic release kinetics. To address this, we developed electrospun nanofibrous scaffolds composed of acetalated dextran (Ace-DEX), a biodegradable polymer with tunable degradation and pH sensitivity, capable of modulating drug release rates. By engineering scaffolds with fast, medium, and slow degradation profiles, we achieved daily paclitaxel release rates of 14.1%, 2.9%, and 1.2%, respectively. In orthotopic glioblastoma mouse models, we found that drug release rate significantly impacted therapeutic outcomes and combining fast and slow-release scaffolds resulted in 78% long-term survival, compared to only 20% with medium-release scaffolds delivering the same total dose. Beyond chemotherapy, we further explored localized immunotherapy using Ace-DEX scaffolds to deliver a TLR7/8 agonist, post-resection. This approach amplified immune activation in the brain and cervical lymph nodes, cleared residual tumor, improved survival, and conferred protection against tumor rechallenge. To streamline scaffold development, we established a machine learning workflow using Gaussian process regression (GPR) to accurately predict in vitro drug release kinetics from 30 Ace-DEX formulations. This predictive, drug-agnostic model accelerates preclinical testing and supports broader clinical translation. Together, these results highlight Ace-DEX nanofiber scaffolds as a versatile and powerful platform for controlled local delivery of chemo- and immunotherapies, with strong potential to improve GBM treatment outcomes.

Bio: Dr. Ainslie is a Eshelman Distinguished Professor in the Division of Pharmacoengineering and Molecular Pharmaceutics at the UNC Eshelman School of Pharmacy, with affiliations in the UNC/NC State Joint Department of Biomedical Engineering and UNC Department of Microbiology and Immunology. Her lab focuses on immunoengineering to prevent and treat cancer, as well as infectious and autoimmune diseases. After completing a PhD in chemical engineering and post docs in biomedical engineering, she started at Ohio State University in 2009 and moved to UNC in 2014. She has over 100 peer reviewed publications, 8 patents, and has received $27M in federal funding as principal investigator to support her work. Her research has helped to shine a light on how polymer properties can tune immune responses for infectious disease vaccines, autoimmune therapies and glioblastoma immunotherapy. Dr. Ainslie received the prestigious 2023 Sato Memorial International Award and was inducted as a Fellow of the Controlled Release Society in 2022 and the American Institute for Medical and Biological Engineering (AIMBE) in 2021. Since 2023, she has also served on the editorial boards of the Journal of Controlled Release and the International Journal of Pharmaceutics.

Seminar Host: Nisarg Shah