Department of Biomedical Engineering
UNIVERSITY OF WISCONSIN–MADISON

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Seminar Series

From Cellular Networks to Therapeutic Predictions: A Data-Driven Approach to Precision Medicine

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Precision medicine aims to tailor prevention, diagnosis, and therapy to individual patients' biological states. We pursue this as a multiscale problem, combining molecular and systems biology approaches with translational AI methods to improve clinical decision-making. In this talk, I focus on our systems-level efforts to predict targeted therapeutic responses in cancer. This challenge is particularly acute because despite extensive molecular profiling capabilities, predicting how therapies affect cellular phenotypes remains a critical barrier to precision oncology. Targeted therapies produce highly variable outcomes due to the adaptive, networked nature of cellular signaling. Comprising over 500 kinases, the protein kinome forms the backbone of these networks and represents a central therapeutic target space. However, predicting how kinome perturbations propagate through cellular systems to shape phenotypic outcomes is a major challenge. My research program addresses this by developing data-driven approaches that link kinase inhibition states to downstream cellular responses, enabling the rational design of single-agent and combination therapeutic strategies. I will discuss our work building predictive models that forecast cellular responses to kinase-targeted therapies, validated experimentally across breast and pancreatic cancer cell lines and patient-derived xenograft models. These models integrate large-scale proteomic and multi-omic data within machine learning frameworks to identify key kinases and network features driving therapeutic outcomes. This work illustrates how systems-level modeling translates molecular data into actionable insights for precision medicine. I'll conclude by highlighting opportunities for research, educational, and translational innovation in BME at UW-Madison.

ABOUT the SPEAKER

Dr. Shawn Gomez is a Professor and Associate Chair for Research in the Lampe Joint Department of Biomedical Engineering at UNC-Chapel Hill and North Carolina State University, as well as a Professor in the Department of Pharmacology at UNC-Chapel Hill and a member of the Cancer Therapeutics Research Program in the Lineberger Comprehensive Cancer Center. He is also founder and Co-Executive Director of FastTraCS, UNC's MedTech incubator within the North Carolina Translational and Clinical Sciences Institute. His laboratory conducts research in precision medicine, spanning molecular systems biology through translational AI applications. His group develops novel approaches for targeted therapy design, innovative diagnostics, and clinical decision support, with the overarching goal of improving patient outcomes. Dr. Gomez received his BS and MS degrees in Aerospace Engineering Sciences from the University of Colorado Boulder and his Doctorate of Engineering Sciences in Biomedical Engineering from Columbia University. He completed postdoctoral training at the Judith P. Sulzberger Columbia Genome Center and the Institut Pasteur in Paris, France, where he was a Florence Gould Scholar and Pasteur Foundation Fellow.

Monday, February 23 at Noon
1003 Engineering Centers (Tong Auditorium)