Research Topics:

- **Glycopolymer Biophysics**

  Large linear glycopolymers known as glycosaminoglycans (GAGs) coat living cells in the form of a glycocalyx that binds to charged cations and biological macromolecules.

- **Biomolecular Condensates**

  Cationic polyelectrolytes such as nucleic acids, glycopolymers and many proteins can form assemblies with cationic protein domains to form 2-phase solutions and many biological functions are controlled using structures.

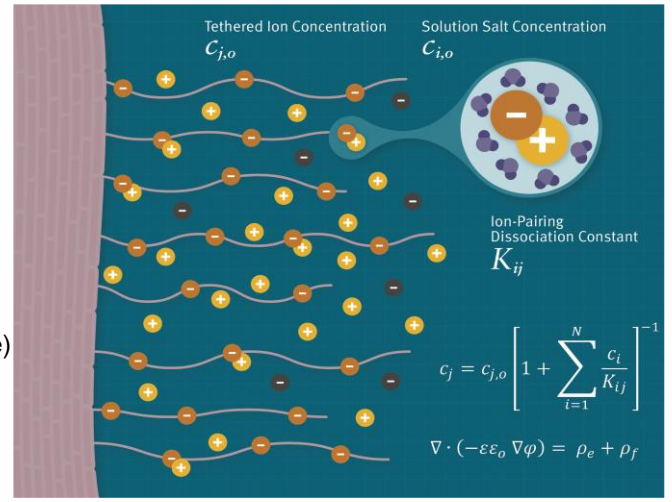
- **Biomolecular Simulation and Modeling**

  All-atom and coarse-grained molecular dynamic (MD) simulations are used to elucidate structure-function relationships. Mean field models known as Born-modified Poisson Nernst Planck are used to elucidate MD observations

Current Work:

Application of Multivalent Innate Immune Signaling Target (MIIST) glycopolymers for managing autoimmunity through control of vascular inflammation, infection, and injury.

A Continuum Model of Mucosa with Glycan-Ion Pairing. James D. Sterling and Shenda M. Baker *Macromolecular Theory and Simulations*, Volume 27, Issue 2, March 2018. (Cover Image)



Contact Information:

James D. Sterling
Vice Provost and Founding Dean of Kummer College of Innovation, Entrepreneurship & Economic Development
Department: Business and Information Technology
Email: jsterling@mst.edu
Website: kummercollege.mst.edu
Phone: (573) 341-4613

Funding: Kummer Institute Foundation

Selected Publications:

- Mathematical modeling of microscale biology: Ion pairing, spatially varying permittivity, and Born energy in glycosaminoglycan brushes; W. Ceely *et al.*, Physical Review E., February 2023, 107:024416.
- Quantitative insights into electrostatics and structure of polymer brushes from microslit electrokinetic experiments and advanced modelling of interfacial electrohydrodynamics; R. Zimmermann *et al.*, Current Opinion in Colloid & Interface Science 2022, 59:101590.
- The role of the cell surface glycocalyx in drug delivery to and through the endothelium; Lu Fu *et al. Advanced Drug Delivery Reviews*, 2022, 184, 114195.
- Ion pairing and dielectric decrement in glycosaminoglycan brushes; James D. Sterling, Wenjuan Jiang, Wesley Botello-Smith and Yun L. Luo, *Journal of Physical Chemistry B*, 2021, 125, 10, 2771-2780.