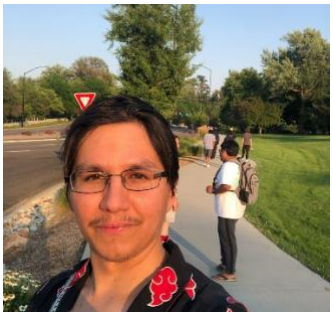
MD Simulations of self Assembling Nanotubes using Drug Amphiphiles

Joel Gallardo[1,2], Augustine Onyema[1,2] , Sharon M. Loverde[1,2]
[1] Chemistry PhD program, The Graduate Center, City University of New York, NY
[2] Department of Chemistry, College of Staten Island, City University of New York, NY

Supramolecular assemblies have applications in many fields, including drug delivery, tissue engineering, catalysis, nanoelectronics, etc. Drug amphiphiles (DAs) are a new class of prodrugs that can self-assemble into nanotubes. The Cui laboratory has designed a drug amphiphile containing camptothecin with better biological activity (Cui et al., JACS, 2019). Our laboratory has characterized the initial stages of the assembly of these DAs using advanced sampling methods in molecular dynamics (Tang et al., JCIM, 2023). Here, we report MD simulations of a new set of DAs with two different linker types. Experimental findings show that these new DAs form nanotubes of varying diameters, with one of the DAs suggested to form a bilayer nanotube. Molecular dynamics simulations suggest that the type of linker used can change the inter vs. intramolecular stacking of the drugs. We are also working to automate the setup of these DAs in tubular morphologies to perform multiple sets of molecular dynamics simulations, to compare with experimentally reported results. These MD simulations will add insight into how DA linker chemistry affects the morphology of the resulting supramolecular nanotube.

1. Su, H., Wang, F., Wang, Y., Cheetham, A. G., & Cui, H. (2019). Macrocyclization of a class of camptothecin analogues into tubular supramolecular polymers. *Journal of the American Chemical Society*, *141*(43), 17107–17111. https://doi.org/10.1021/jacs.9b09848
2. Tang, P. K., Khatua, P., Carnevale, V., & Loverde, S. M. (2023). Exploration of the nucleation pathway for supramolecular fibers. *Journal of Chemical Information and Modeling*, *63*(8), 2419-2426. https://doi.org/10.1021/acs.jcim.3c00049



Joel gallardo