Molecular Modeling Guided Drug Design

Feinberg, Hannah (School: BASIS Tucson North)

Opioids are leading contributors to drug overdose deaths. Currently, there are no pain medications without risk of misuse, abuse, and addiction. Oxytocin, a pituitary hormone, holds analgesic properties. My lab, inspired by the structure of the molecule, created a glycopeptide drug that has the potential to be less addictive and less harmful for the body than conventional pain medications (i.e., morphine, fentanyl). Using the drug discovery software, MOE (Molecular Operating Environment), I attempted to find more thermodynamically favorable analogues of the lead drug candidate, SSOxy-6. Using two Cryo-EM structures, I mutated the tyrosine of the nine amino acid long chain to create thirty-eight different analogues. Most analogues saw an increase in energy after the mutation, except for analogue 6A. This analogue contained a methyl group ortho to the hydroxide. This could be due to increased entropy and intramolecular hydrogen bonding. If an analogue with lower energy than the original SSOxy-6 molecule is found, this could save time for my lab while they research more successful versions of the SSOxy-6 glycopeptide drugs. Receptor selectivity is key to creating effective drugs that do not produce off-target effects.

Awards Won:

University of Texas at Arlington College of Science: Alternates in case any of your recipients do not accept the award (not to be read aloud)

Arizona State University: Arizona State University ISEF Scholarship (valued at up to $52,000 each)

Long Island University: Presidential Scholarships

University of Arizona: Renewal Tuition Scholarship