“Does Nature Love Chemistry and Physics as Much as I Do?”

Abstract:
My lab is working to understand how evolutionary processes affect physicochemical properties of proteins, and vice versa. Specifically, we are characterizing how dynamical properties vary as function of protein family divergence. Using computational models grounded in biophysics, our work has revealed that protein dynamics are extremely sensitive to even minimal perturbations. Typically, these perturbations lead to rich mixtures of both increased flexibility and increased rigidity. Across whole protein families, this sensitivity can lead to dramatically different dynamical profiles. Yet, the observed differences are often related to the evolutionary distance between proteins. For example, we recently demonstrated in a statistically robust way that changes in dynamical properties across the biomedically important β-lactamase enzyme family closely parallels the evolutionary history, meaning that “Yes! Nature does appear to love chemistry and physics as much as we do.”