

# 1 Abstract

Disordered proteins are present in at least 40% of human proteins, including signaling molecules. Disordered signaling proteins can exhibit nonlinear signaling behavior, but how this behavior develops from disorder is not well understood. Here we explore how disordered proteins impact singular and multi-site ligand binding through a variety of disorder-specific phenomena. In addition to basic properties of disordered protein interactions, we investigate disorder-to-order transitions, electrostatic membrane association, simultaneous ligand binding and effects of surface presence. We find that disordered proteins may create positive or negative cooperativity and intrinsic sequential binding. These effects are influenced by the length of the disordered protein, size of the binding ligand, location of the binding sites along the polymer and presence or absence of a surface. Intrinsically disordered proteins themselves may therefore act as signaling modules that contribute complex signaling behavior to a network.