The thick “sugar coating” that covers all of our cells plays important roles in biology and disease. For instance, the complex carbohydrate structures found in this coating, called glycans, change to abnormal states in diseases like cancer. However, understanding how glycans affect biological processes and how we can target these molecules for therapies has been difficult. As a result, novel chemical biology tools are needed to meet the demand for new information and advance our understanding of the function of these important biomolecules. In this talk, I will describe the interdisciplinary approaches the Capicciotti Group is employing to tackle the challenge of studying glycan function in cells. Using chemical and biochemical strategies, we are examining the roles of precise complex glycan structures in immunological and inflammatory responses, and how specific glycan-protein interactions influence cancer immunoevasion. Approaches for imaging cancer-associated glycans and identifying novel glycan biomarkers as therapeutics targets to facilitate the development of glycan-based strategies for combatting disease will also be discussed.