Pathogenic mycobacteria cause devastating human diseases, including leprosy, Buruli ulcers, and tuberculosis. Mycobacterium tuberculosis (Mtb) is present in one-third of the world’s population and therefore may be classified as a commensal; yet about 1.4 million people die of tuberculosis each year. Sensitive methods for diagnosis of active mycobacterial infections are needed as are methods for identifying inhibitors. Our research focuses on the cell envelope, which is composed of "exotic" carbohydrates and lipids. Indeed, we focus on the saccharide building blocks used by bacteria that are absent from humans. We seek to understand how mycobacterial species combine distinct building blocks to assemble a cell envelope barrier that is durable, largely impermeable, and dynamic. By leveraging our understanding of the mechanisms underlying cell envelope biosynthesis, we have developed chemical probes to understand how antibiotics function and to elucidate the mechanisms by which bacteria build their cell envelopes. Such chemical probes can function as diagnostics and lead to the discovery of new classes of anti-infective agents.