Public Abstract
First Name:Wei
Middle Name:
Last Name:Wang
Adviser's First Name:Thomas
Adviser's Last Name:Mawhinney
Co-Adviser's First Name:
Co-Adviser's Last Name:
Graduation Term:SS 2014
Department:Biochemistry
Degree:PhD
Title:MONOSACCHARIDE-BINDING OF CYSTIC FIBROSIS PSEUDOMONAS AERUGINOSA: GLYCOPOLYMER PREPARATION, METHODS DEVELOPMENT AND PHENOTYPE ASSESSMENT

The chronic and progressive Pseudomonas aeruginosa infection in cystic fibrosis (CF) patients' lungs starts with the specific binding by bacterial lectins (sugar-binding proteins) to certain sugars on the respiratory tract. Blocking this binding with competitive carbohydrates (anti-adhesion therapy) offers a promising therapeutic strategy. Due to the diverse living microenvironment of the bacteria in the lungs, P. aeruginosa isolated from CF patients often have different appearances, which is directly related to their unusually high antibiotic-resistance. Therefore, we asked whether P. aeruginosa with different appearances also have different carbohydrate-binding patterns, and what simple sugars can be bound by the bacteria on a cellular level. To answer these questions, a group of P. aeruginosa laboratory strains and clinical isolates with various appearances were tested against a panel of synthesized and commercial fluorescent glycopolymers possessing distinct pendant sugars. Using a controlled co-polymerization strategy, a group of linear fluorescent glycopolymers were successfully prepared and employed in bacterial binding tests. In the P. aeruginosa binding tests where commercial glycopolymers were mainly used, alpha-D-galactose, beta-D-N-acetylgalactosamine, or beta-D-galactose-3-sulfate demonstrated strong binding with all the strains and clinical isolates. But within any positively-binding population, only ~1% of the bacteria showed observable binding. These findings provide new perspective for both the pathogenesis of the P. aeruginosa infection in CF lungs and the sugar-inhalation anti-adhesion treatment. This protocol can also be applied to other pathogenic bacteria whose carbohydrate-binding behaviors are of interest for researchers.