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Modification of silicone surfaces with carbohydrates to promote formation of non-pathogenic biofilms against pathogenic colonization

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Device-associated infections, such as catheter-associated urinary tract infection (CAUTI), are due to formation of pathogenic biofilms on the devices. In these biofilms, pathogens are embarked in their secreted extracellular polymeric substances (EPS) that shield them from antimicrobial agents and host defense and facilitate their development of drug resistance. Despite extensive research, long-term prevention of pathogenic colonization and biofilm formation in a high nutrient environment remains a great challenge. Since biofouling and the subsequent pathogen colonization is eventually inevitable, a new strategy based on bacterial interference using non-pathogenic bacteria to guard against pathogens has attracted increasing interest. Crucial to the success of this strategy is to establish a high coverage and stable biofilm of non-pathogenic bacteria on the surface. We have been using a non-pathogenic *E. coli* strain with type I fimbriae to interfere the colonization of uropathogenic bacteria on silicone as the most common biomedical material. To promote the formation of stable and densely packed benign *E. coli* biofilms on silicone surfaces, we developed an efficient method for modification of the surface with mannoside ligands. The resultant biofilms prevented the colonization of several strains of antibiotic-resistant uropathogenic isolates at a concentration thousand times higher than the diagnostic threshold for CAUTI. Using the well-defined model systems, we are also studying the initial bacterial adhesion and biofilm formation on surfaces presenting mannosides and polysaccharides, poly(N-acetylglucosamine). Our work indicated that the strong binding between the immobilized carbohydrates and the bacteria promoted the production and secretion of EPS consisting of proteins and polysaccharides that are crucial to the biofilm coverage and stability. The work will be discussed in this talk.

Biography

Chengzhi Cai is a Professor of Chemistry at the University of Houston. He has obtained his BS and MS from South China University of Technology, and a PhD degree on Carbohydrate Chemistry from the Institute of Organic Chemistry at ETH, Zurich. After a Postdoctoral research stay at the Institute of Quantum Electronics of ETH, he has joined UH in 2000. His research has been broadly involved in organic thin films, surface biofunctionalization, bioanalytical, and click chemistry for bioconjugation.

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