Combatting Biofilms by Disrupting Bacteria Quorum Sensing

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Technology description

Bacteria can grow into harmful communities called biofilms that are present almost everywhere on earth – from hospitals to food facilities. Biofilms are especially difficult to clear because they are encased in a protective extracellular matrix that resists host immune response and standard antibiotics.

For many bacteria species, biofilm formation is under the direct control of the cell-cell signaling pathway termed quorum sensing (QS). QS systems coordinate important life-cycle processes like swarming and conjugation.
Disrupting QS in bacteria could be a powerful tool against biofilms. This would especially be important in the fight against Gram-negative bacteria, which have frustrated other modes of attack. This type of bacteria includes a species calledPseudomonas aeruginosathat grows pervasively on medical devices, plagues burn victims and AIDS patients, and causes fatal lung infections in cystic fibrosis patients. UW–Madison researchers have developed a set of 2-aminobenzimidazole (2-ABI) derivatives that can almost totally inhibit or disperse biofilms by disrupting QS in Gram-negative bacteria, particularlyP. aeruginosa. These small molecules have previously been shown to fight Gram-positive biofilm growth. The compounds can be developed using known methods and applied in many forms, such as anti-biofilm coatings, hydrogels, disinfectants and pharmaceutical compositions. They work by acting as replacements for naturally occurring QS ligands in the ligand-protein binding system of bacteria. In this way, the compounds disturb coordination signals and thereby impede biofilm formation.

Additional Information

Frei R., Breitbach A.S. and Blackwell H.E. 2012. 2-Aminobenzimidazole Derivatives Strongly Inhibit and Disperse Pseudomonas aeruginosa Biofilms. Angewandte Chemie-International Ed. 51, 5226-5229.

Application area

Inhibiting or dispersing biofilm of Gram-negative bacteria
Treating infections of Gram-negative bacteria

Advantages

Uniquely targets the QS pathway
Can be used to treat Gram-negative bacterial infection
Increases the susceptibility of bacteria to antibiotics
Could decrease cost of treating bacterial infections involving biofilms, which exceeds $1 billion per year in the U.S.
First evidence linking 2-ABI biofilm agents and QS

Institution

Wisconsin Alumni Research Foundation

Inventors

Helen Blackwell
David Lynn

联系我们

叶先生

电 话：021-65679356

手 机：13414935137

邮 箱：yeyingsheng@zf-ym.com