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Bacterial 'sex' causes antibiotic resistance

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Some disease-causing bacteria are becoming resistant to antibiotics because they have peculiar sex lives, say researchers publishing new results today in the journal *Science*. The new study helps scientists understand how bacteria develop resistance to antibiotics, which is a major challenge for those treating infectious diseases, say the authors from Imperial College London.

Today's research looks at bacteria called pneumococcus (*Streptococcus pneumoniae*), which cause diseases including pneumonia and bacterial meningitis. Pneumococcal infections cause approximately one million deaths every year globally and the bacteria are becoming resistant to many antibiotics, making treatment increasingly difficult. The scientists behind today's study believe this resistance is due to the pneumococcal bacteria adapting by occasionally picking up DNA from other bacteria, even from other species.

Dr William Hanage, the lead author of the study from Imperial College London, said: "Bacteria have very peculiar sex lives. When humans have kids they mix up their DNA with that of their partner, but bacteria can pick up DNA from all sorts of places, even other species. Our research shows that bacteria which do this, that is undergo sex, with their own and other species are more likely to develop resistance to antibiotics, protecting them from being killed by these drugs."

Bacteria reproduce asexually, by splitting in two to produce identical 'daughter' cells. Sometimes, however, they can take up DNA from other bacteria or the environment, and incorporate it into their own genome.

This mixing process, called recombination, is what happens in animals during sexual reproduction. It is most common between bacteria of the same species but, unlike animals, bacteria can sometimes undergo recombination with different species of bacteria, which means the daughter cells end up with DNA from those species.

Some combinations of DNA help bacteria to survive better. It appears that antibiotic resistant strains of pneumococcus are more likely to mix up their DNA in this way, and so are more likely to hit upon the adaptation which helps them resist antibiotic treatment.

Dr William Hanage added: "Antibiotic resistance is a growing problem, particularly for potentially dangerous pneumococcal infections. Our new findings help us to understand how bacteria can wriggle their way out of tight spaces, finding ways to evade the drugs we bombard them with. Ultimately, we hope that we could use this knowledge to limit the emergence of new types of antibiotic resistance."

The researchers examined DNA from 1,930 different *S. pneumoniae* strains, as well as three closely related species, *S. mitis*, *S. pseudopneumoniae* and *S. oralis* collected by a method called Multi Locus Sequence Typing (MLST). They were able to find strains with DNA which suggested recombination, or the mixing of DNA with other members of the same species, and other closely related ones.

The researchers then compared these results with data on resistance to the commonly-used antibiotics penicillin, erythromycin, tetracycline, chloramphenicol and cefotaxime. They found that bacteria with mixed DNA were more likely to be resistant to antibiotics, suggesting a link between recombination and antibiotic resistance.

Source: Imperial College London (news : web)