Antibiotic multiresistance: why bacteria are so effective

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(PhysOrg.com) -- In an article due to be published in *Science*, teams from the Institut Pasteurand the University of Limoges, associated with the CNRS and Inserm, decipherfor the first time the molecular mechanism that enables bacteria to acquiremultiresistance to antibiotics, and that even allows them to adapt thisresistance to their environment. This discovery highlights the difficulties thatwill have to be tackled by public health strategies if they are to address theproblems created by multiresistance.

Multiresistance of bacteria to antibiotics is a phenomenon that appeared when these drugsbegan to be used in the 1950s. It was subsequently discovered that resistance genes wereeasily captured, disseminated and exchanged from one bacterium to another by a systeminvolving genetic "copying and pasting" of the structures containing these genes, known asintegrons. But the dynamics of these exchanges, which governs the multiresistancedevelopment in bacteria, remained unknown.

The work of researchers from the Institut Pasteur associated with the CNRS (France) and from Inserm, within the Limoges Faculty of Medicine, in cooperation with Spanish teams, reveals for thefirst time today how bacteria acquire these multiresistance properties. It is actually theantibiotics themselves that trigger the synthesis of the bacterial enzyme that captures theresistance genes and enables their expression in the integron.

This enzyme also promotes the random rearrangement of the resistance

genes within theintegron. The order of these genes in the integron determines the degree of priority for theirexpression: the first are expressed most highly and give the bacteria the correspondingresistance. The last remain silent, although they are kept in reserve. When a newrearrangement occurs, triggered by taking an antibiotic, for example, they are likely to bemoved to the first positions, and give the bacteria the required resistance to this drug. Thebacteria with the right "combination" of genes will therefore be able to survive and ensurethat the resistance potential is maintained from generation to generation.

This work shows the extent to which strategies of bacterial adaptation to antibiotics areeffective, in both the short and the long term. It therefore clearly demonstrates the difficultiesassociated with bacterial genetics that future public health measures will have to take intoaccount if they are to tackle the problem of multiresistance.

More information: The SOS response controls integron recombination, *Science*, May 22, 2009.

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