MedicalXpress

Targeting bacterial gas defenses allow for increased efficacy of numerous antibiotics

November 17 2011

Although scientists have known for centuries that many bacteria produce hydrogen sulfide (H2S) it was thought to be simply a toxic by-product of cellular activity. Now, researchers at NYU School of Medicine have discovered H2S in fact plays a major role in protecting bacteria from the effects of numerous different antibiotics.

In the study led by Evgeny Nudler, PhD, the Julie Wilson Anderson Professor of Biochemistry at NYU School of Medicine, researchers found evidence that H2S acts as a general defense mechanism against oxidative stress, the process through which many antibiotics kill bacteria. This information provides the basis for developing new techniques to suppress this universal bacterial defense mechanism and make bacteria more susceptible to antibiotics at lower doses. It also paves the way for reversing antibiotic resistance in human pathogens such as Staphylococcus, Pseudomonas, E. coli, and many others. The study's findings were published online on November 17 edition of *Science*.

"Surprisingly little has been known about H2S biochemistry and physiology in common bacteria" said Dr. Nudler. "We are excited about the potential impact this research may have on the growing problem of microbial resistance. These findings suggest a conceptually new approach, an adjuvant therapy that targets bacterial gas defenses and thus increases the efficacy of many clinically used antibiotics."

More specifically, the study showed that integrated mechanism of H2S-mediated protection against oxidative stress also protects against

antibiotics. The research provides direct support for the emerging concept of the pro-oxidative action of many antibiotics. In addition, the study demonstrates that bacteria that generate both H2S and nitric oxide (NO) simultaneously, such as B. anthracis (a causative of anthrax), cannot survive without both gases, even under normal growth conditions. One gas makes up for the lack of the other and at least one of them is essential.

In a previous study Dr. Nudler and his colleagues demonstrated that NO plays a similar role in protecting bacteria from antibiotics (*Science* September 9, 2009). However, because NO is present in only a limited number of bacteria while hydrogen sulfide synthesis occurs in essentially all bacteria, the practical implications of this new finding is extremely wide-ranging.

Provided by New York University School of Medicine