Researchers examine how bacteria become resistant to antibiotics

October 5 2010

A study by two Florida State University biochemists makes an important contribution to science's understanding of a serious problem causing concern worldwide: the growing resistance of some harmful bacteria to the drugs that were intended to kill them.

Investigating exactly how bacteria learn to fend off antibiotics prescribed to treat infections is the subject of new research by Assistant Professor Brian G. Miller of FSU's Department of Chemistry and Biochemistry and one of his graduate research assistants, Kevin K. Desai. They have found that bacteria are remarkably resilient to toxic substances, such as antibiotics, because bacteria have the innate ability to produce a large variety of proteins. Those proteins then are able to do things such as pump toxins out or alter toxins so that they can no longer kill the bacteria.

"Most of us take antibiotics to eliminate infections without considering what would happen if they failed to work," said Kevin Desai, a graduate research assistant in Florida State's Department of Chemistry and Biochemistry. "While treating bacterial infections has typically been as easy as swallowing a pill, researchers are apprehensive about the increasing frequency of infections that are resistant to antibiotics, and are searching for ways to regain the upper hand."

In their study, Miller and Desai learned that about 2 percent of all the proteins produced by the model bacterium E. coli can be linked to enabling resistance to a single toxin called bromoacetate. Their research

also has implications in elucidating the function of specific proteins and understanding how bacteria in the environment can survive in the presence of toxic manmade chemicals such as pesticides.

A paper describing Desai and Miller's work was published this week in the prestigious journal Proceedings of the National Academy of Sciences. That paper is titled "Recruitment of Genes and Enzymes Conferring Resistance to the Nonnatural Toxin Bromoacetate."

"The recent rise of antibiotic resistance demonstrates that bacteria are capable of rapidly evolving evasive strategies," they wrote. "It also has exposed our lack of knowledge about the evolutionary processes leading to resistance."

Understanding the mechanisms by which bacteria evade environmental threats has direct relevance for understanding and combating the rise of antibiotic resistance, Desai and Miller added.

The techniques described in the paper will be highly useful for other researchers in the field because it will allow them to predict the resistance to specific antibiotics. Any resistance mechanisms identified could then be inhibited so that the antibiotics will retain their effectiveness.

Provided by Florida State University