Protein assassin: Scientists find that the unfolded end of a protein can kill E. coli-like bacteria selectively

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When bacteria wage a turf war, some of the combatants have an extra weapon. Certain strains of the bacteria *E. coli* produce proteins that kill competing *E. coli* and other like microbes, and researchers from Newcastle University in England have recently discovered something surprising about one of these lethal proteins: even after the toxic folded portion of the protein is removed, the unfolded end is still deadly. The finding may one day help scientists find new, more targeted ways to kill antibiotic-resistant microbes. The researchers will present their results at the 56th Annual Meeting of the Biophysical Society (BPS), held Feb. 25-29 in San Diego, Calif.

The Newcastle research team focused their attention on a specific bacteria-killing protein called Colicin N. Scientists traditionally divide the structure of Colicin N into three separate parts, or domains: a receptor binding domain that helps the colicin latch onto the bacterial membrane; a translocation domain that helps the colicin wiggle into the cells; and a toxic domain that punches holes in the membrane from the inside, so that potassium, an element essential to proper cell function, leaks out of the bacteria.

Although scientists believe that the translocation domain of Colicin N, called ColN-T, plays a role in transporting the protein across the cell membrane, the exact mechanism is not well understood. In order to learn more about how ColN-T functions, the Newcastle researchers isolated

this part of the protein and added it to a fluid containing Colicin N-susceptible *E. coli*. The team thought that, by itself, ColN-T might block the translocation pathways, giving the bacteria a measure of protection against full-length Colicin N; but instead the *E. coli* started leaking potassium and dying shortly after the ColN-T was introduced into their environment. It turned out the seemingly disarmed protein could still kill.

The results were "entirely unexpected," says Chris Johnson, a molecular biologist at Newcastle University and a member of the team. "Until recently we had always assumed that the role of the translocation domain was solely to help transport the toxic pore-forming domain of Colicin N into the cell."

As yet, the scientists are unsure how ColN-T single-handedly causes bacterial membranes to leak potassium, but determining this mechanism is the team's next primary goal. "We have lots of new experiments to design," says Johnson.

ColN-T has a number of properties that make it an appealing model for the development of new antibacterial therapies. Unlike most antimicrobial proteins, ColN-T does not disrupt model membranes, and its activity is strictly dependent upon two receptor proteins unique to *E. coli*-like bacteria. This specificity, along with ColN-T's small size, means that once scientists know the unfolded protein's killing secrets, they may be able to design small molecule mimics that use the same mechanism to slay *E. coli*-like bacteria in humanity's own turf wars with the microbes.

More information: The presentation, "Targeted killing of *Escherichia coli* by an unfolded protein," is at 10:30 a.m. on Wednesday, Feb. 29, 2012, in the San Diego Convention Center, Hall FGH. ABSTRACT: http://tinyurl.com/7vjmqc7