In decision to grow, bacteria follow the crowd

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When it comes to the decision to wake up and grow, bacterial spores "listen in" to find out what their neighbors are doing and then they follow the crowd, according to a new report in the October 31st issue of the journal *Cell,* a Cell Press publication. Although there is still a lot to learn about how this process works, the discovery could lead to a new kind of antimicrobial agent that works not by killing active bacteria, but by keeping dormant bacteria—which typically resist traditional antibiotics—inactive.

The researchers show that the spores of a soil-dwelling bacteria can sense the presence of so-called muropeptide fragments released from the cell walls of other growing bacteria. Those muropeptides act as powerful germinants, stimulating the spores to exit the safety of their dormant state and make a go of it.

As other bacteria, including those responsible for diseases like tuberculosis and staph infection, harbor a version of the receptor responsible for this ability in the bacteria under study, the researchers said they think the mechanism they've uncovered will prove to be universal.

"[From the bacteria's perspective,] dormancy is a great state," said Jonathan Dworkin of Columbia University. "They are invulnerable to antibiotics. If you keep them in that state, you can't kill them but they don't grow either. Antibiotics usually kill bacteria by preventing some essential process, but if an antibiotic instead kept dormant bacteria from emerging, it would be essentially like killing them." They'd be stuck in a

state of suspended animation.

In the new study, the researchers found that muropeptides derived from cultures of growing cells stimulate the germination of dormant Bacillus subtilis spores. Diverse bacteria can serve as the source for those muropeptide molecules, but the key is a single amino acid ingredient, they found.

The spores ability to receive the signal depends on a eukaryotic-like Ser/Thr membrane kinase receptor (PrkC). Indeed, a small molecule known to stimulate related kinases is sufficient to spark the activity of the sleeping spores. Another small molecule called staurosporine, which inhibits related kinases, also prevents spores from activating in the presence of muropeptide.

Dworkin noted that the immune systems of animals recognize the presence of foreign invaders in a similar way, by detecting chains of muropeptide (called peptidoglycans).

" The recognition of peptidoglycans is central to innate immunity," he said. "This shows that bacteria do a similar thing, but for different reasons." His team is anxious to understand the details better to make the comparison to the immune system as "there may be deep similarities."

In addition to the promise for a new type of antibiotic medication, the news may stand to benefit the food industry.

Bacterial spores are also a significant problem for food preservation, Dworkin said, because they can withstand heat sterilization. "If the food industry could find ways to control spore germination, that may be just as good as killing them," he said.

Source: Cell Press