Listeria clever at finding its way into bloodstream, causing sickness

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Arun Bhunia determined that listeria bacteria can pass between intestinal cells and triggers a mechanism that increases listeria's ability to enter the cells. Credit: Purdue Agricultural Communication photo/Tom Campbell

Pathogenic listeria tricks intestinal cells into helping it pass through those cells to make people ill, and, if that doesn't work, the bacteria simply goes around the cells, according to a Purdue University study.

Arun Bhunia, a professor of food science, and Kristin Burkholder, a former Purdue graduate student who is now a postdoctoral researcher in microbiology and immunology at the University of Michigan Medical School, found that listeria, even in low doses, somehow triggers intestinal cells to express a new protein, heat shock protein 60, that acts as a receptor for listeria. This may allow the bacteria to enter the cells in the intestinal wall and exit into a person's bloodstream. Bhunia and

Burkholder's findings were published in the early online version of the journal *Infection and Immunity*.

"It's possible that host cells generate more of these proteins in order to protect themselves during a stressful event such as infection," Burkholder said. "Our data suggest that listeria may benefit from this by actually using those proteins as receptors to enhance infection."

Listeria monocytogenes is a foodborne bacteria that can cause fever, muscle aches, nausea and diarrhea, as well as headaches, stiff neck, confusion, loss of balance and convulsions if it spreads to the nervous system. According to the U.S. Centers for Disease Control and Prevention, it sickens about 2,500 and kills 500 people each year in the United States and primarily affects pregnant women, newborns, older adults and those with weakened immune systems.

The findings suggest that listeria may pass between intestinal cells to sort of seep out of the intestines and into the bloodstream to cause infection.

"That can expedite the infection," Bhunia said.

Measurable increases of the heat shock 60 protein were detected when listeria was introduced to cultured intestinal cells.

Bhunia and Burkholder also introduced listeria to intestinal cells in the upper half of a dual-chamber container and counted the number of bacteria that passed through the cells and appeared in the lower chamber.

The bacteria moved to the lower chamber faster than it is known to do when moving through cells, and did so even when a mutant form of the bacteria that do not invade the intestinal cells was used. This suggests the bacteria are moving around the cells, Bhunia said.

"The infective dose is very low. Even 100 to 1,000 listeria cells can cause infection," Bhunia said. "We believe that these mechanisms are what allow listeria to cause infections at such low levels."

Bhunia said he next would try to understand how listeria and the heat shock 60 protein interact and work to develop methods to protect intestinal cells from the bacteria. The Center for Food Safety Engineering at Purdue funded part of the research.

Provided by Purdue University