What fuels Salmonella's invasion strategy?

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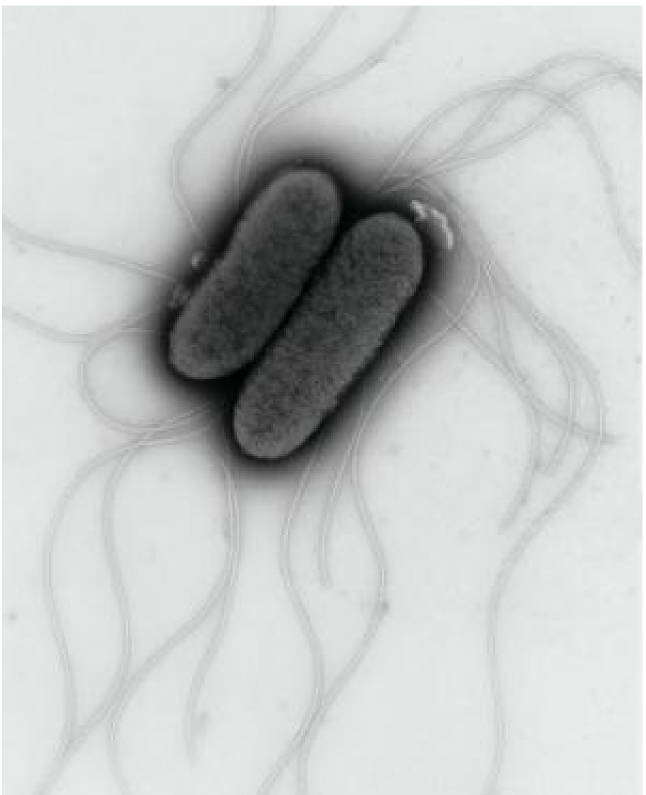

This is *Salmonella* Typhimurium. Credit: Institute of Food Research

Certain strains of *Salmonella* bacteria such as *Salmonella Typhimurium* (*S. Typhimurium*) are among of the most common causes of food-borne gastroenteritis. Other strains of *Salmonella* such as *S.* Typhi are responsible for typhoid fever, which causes 200,000 deaths around the world each year. Ensuring food is clear of contamination, and water is clean are key to reducing the effects *Salmonella* can have, but we also need more effective ways to combat *Salmonella* once it's inside our bodies.

To address this the Institute of Food Research, strategically supported by the Biotechnology and Biological Sciences Research Council, has been studying *S. Typhimurium* bacteria to understand, not only how they transmit through the food chain, but why they are so effective and dangerous once inside us.

If we consume food or water contaminated with *S. Typhimurium*, the first stage of infection is to get into the cells that line our gut. These epithelial cells are adapted to defend against such attacks, but *Salmonella* has a wealth of strategies to overcome these and make it more virulent. It also needs these virulence genes to overcome the cells of the immune system, which it invades to move around the body. We are learning a lot about these virulence genes, but until this new study, published in the journal *PLOS ONE*, we didn't know how *Salmonella* fuelled itself for this. A source of energy and nutrition is vital, and knowing what *Salmonella* uses could inform new strategies to prevent infection.

To discover more about *Salmonella*'s feeding habits, Dr Arthur Thompson and his team constructed *S. Typhimurium* strains lacking certain key genes in important metabolic pathways. They then examined how well these mutated strains reproduced in human epithelial cells, grown in cultures.

"We found that glucose is the major nutrient used by *S. Typhimurium*," said Dr Thompson. *Salmonella* converts glucose to pyruvate in a process called glycolysis, which also releases energy needed to fuel growth and reproduction. Knocking out one enzyme in glycolysis, and enzymes used to transport glucose into the bacteria severely reduced *S. Typhimurium*'s ability to reproduce in epithelial cells, but didn't eradicate it completely. "This suggests that although *S. Typhimurium* requires glucose, it is also able to use other nutrients, and that's something we're now studying," said Dr Thompson.

This contrasts with previous findings from similar experiments on macrophage cells by the IFR team, as for successful macrophage invasion, glycolysis is absolutely essential. Macrophages are the immune cells sent to destroy *Salmonella*, but instead *Salmonella* invades the macrophages. Infected macrophages can carry *Salmonella* around the body causing a potentially fatal systemic infection.

"We now have a much more complete picture of the nutritional needs of *Salmonella*, which is important since this information may also suggest new ways to develop potential therapeutic interventions," said Dr Thompson.

Provided by Norwich BioScience Institutes

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