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The new phage therapy: Using whole genome analysis to develop novel approaches to controlling *Salmonella*

Salmonella is an important cause of global foodborne illness. The World Health Organization estimates that, each year, approximately 600 million people become sick, and 420,000 die from foodborne illnesses. Of these, *Salmonella* accounts for 93 million illnesses and 150,000 deaths. While foods such as poultry have long been recognized as causes of *Salmonella* food poisoning, fresh fruits and vegetables have recently emerged as important sources of *Salmonella*. Thus, there is a need to develop better methods to reduce the presence of *Salmonella* in foods. Ideally these methods should also be applicable to control of other foodborne pathogens. Whole genomic sequence analysis of *Salmonella* isolated from diverse sources revealed a large number of prophages residing within the chromosome. Many of these prophages can be induced, resulting in lysis of their bacterial host. We were therefore interested in evaluationg induction of prophages and subsequent bacterial death could be employed as a novel strategy to control *Salmonella* in foods. Growth of *Salmonella* from diverse serovars exposed to a phage inducer (0 or 2 ug/ml mitomycin C) was monitored by OD600. Release of induced prophages from the host was confirmed by subjecting the lysates to PCR to detect phage-specific integrases. Additionally, the ability of mitomycin C to induce prophages in *Salmonella* Duesseldorf growing on fresh produce was evaluated by inoculating the stem scar of red greenhouse tomatoes or spinach leaves with 5x107 and 5x108 cells, respectively. After drying, mitomycin C (6 ug/mL) was sprayed onto each sample, while control samples were sprayed with water. Following overnight incubation, the bacterial cells were recovered and plate counts were performed. Beginning at 3 hours after addition of mitomycin C, growth of *Salmonella* strains resulted in a marked decrease in OD600. PCR confirmed bacterial release of prophages in these lysates. For example, a three-log reduction in S. Duesseldorf (and *E. coli* O157:H7) was observed on tomatoes sprayed with mitomycin C compared to those sprayed with water, while a one-log reduction in *E. coli* O157:H7 was obtained on spinach.These findings serve as a proof of concept demonstrating that prophage induction can efficiently control bacterial foodborne pathogens on fresh produce.

Biography

Lawrence D. Goodridge is a native of Hamilton, Ontario, Canada, and received his Ph.D. from the University of Guelph (pronounced Gwelf) in Guelph, Ontario, Canada with a major emphasis in Food Microbiology and Food Safety in 2002. Currently, he is the Ian and Jayne Munro Chair in Food Safety at McGill University. His primary research interest is the use of bacteriophages to study and solve problems associated with the production of food. He has published more than 55 peer reviewed publications and book chapters on topics related to food safety.

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