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Salmonella metabolism and its effect on host colonization of food-producing animals

Infection of food-producing animals by *Salmonella* generally results in asymptomatic colonization of the intestines. Recently, we have begun to recognize that nutritional requirements of *Salmonella* play an important role in colonization. *Salmonella* typhimurium possesses three mannose-family sugar phosphotransferase (PTS) permeases which are absent in most closely related bacteria and whose expression is controlled by the transcription factor RpoN. We identified substrates for two of these PTS permeases and demonstrated roles for catabolic enzymes associated with them. Specifically, we discovered that one of the PTS permeases transports D-glucosaminate and the associated enzymes convert D-glucosaminate-6-phosphate to 2-keto-3-deoxy-D-gluconate-6-phosphate, via a D-glucosaminate-6-phosphate ammonia-lyase with D-amino specificity, which is subsequently converted to pyruvate and glyceraldehyde-3-phosphate, a pathway previously unknown. It seems likely that D-glucosaminate, which can be oxidized non-enzymatically or oxidized by the action of glucose oxidase or other hexose oxidases, would be available to *Salmonella*. Glucose oxidase is a PQQ-dependent enzyme localized in the periplasmic space of E. coli, possibly other gram-negative bacteria, allowing any D-glucosaminate produced from the oxidation of D-glucosamine by glucose oxidase to be free to diffuse across the outer membrane and be readily available. A second mannose family PTS permease is responsible for transporting fructoselysine, an Amadori product and glucoselysine, a Heynes product. Deglycase enzymes associated with this PTS permease cleave the phosphorylated substrates to release lysine and glucose-6-phosphate or fructose-6-phosphate, which are further catabolized. It seems probable that the utilization of other glycation products is important for efficient host colonization, which is indicated by our further work on the third PTS operon. Consistent with the hypothesis that *Salmonella*'s nutritional requirements play a role in colonization, results from our chicken studies revealed that at least one of the three mannose-family PTS permeases are important for *Salmonella* survival within the chicken gastrointestinal tract.

Biography

Katherine Miller currently works with Food Safety Net Services to further the goal of maintaining food safety and quality. She has received her Bachelor of Science in Biology from Missouri Southern State University. She has obtained her PhD in Microbiology from the University of Georgia and completed her Postdoctoral training in Microbial Infection and Disease at The Ohio State University. Her research focus has been on the interactions of *Salmonella* and its host(s). Her previous research includes examining *Salmonella* metabolism and host colonization. She and her colleges' discovery of a novel pathway for transportation of D-glucosaminic acid (Miller KA, et al., 2013) was the foundation further studies into the biochemical mechanisms of this PTS's associated enzymes. Collaborative efforts, including, bacteriological; molecular; genetic; biochemical; -omic driven and animal colonization approaches; has allowed for diverse approaches in examining *Salmonella* metabolism involving these three RpoN-dependent mannose family PTS permease.

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