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## CAUGHT 'N THE NET

### Consideration Must Be Given To Specific Strains of *Escherichia coli* O157:H7

By Dr. Gary C. Smith



"How *Escherichia coli* react in a laboratory may be markedly different from how 'wild' pathogenic *E. coli* behave in the real world" said Karin Heurlier (University of Nottingham, England) at the Society for General Microbiology in September 2009.<sup>1</sup> Using high throughput phenotypic microarrays, Heurlier found that some of the genetic differences among kinds of *E. coli* enable the pathogenic strains to have markedly different growth characteristics and to thwart the stresses of modern food processing techniques. For example, pathogenic *E. coli* O157:H7 can use a range of carbon sources from vegetal origin, while a commonly studied non-pathogenic laboratory *E. coli* strain (K-12) could not; this would be an indispensable trait to be able to survive on vegetal food (e.g., lettuce, spinach) until reaching the human host. Research studies and validation tests intended to define handling and processing of food in order to effect a more robust eradication of *E. coli* cannot use the laboratory strain as a model, as it is not representative, and — instead — must use a panel of pathogenic *E. coli* that are identified as sources of food poisoning, because they all have specific resistance characteristics.

Researchers at Colorado State University<sup>2</sup> investigated the nature of *E. coli* O157:H7 colonization of feedlot cattle during the final 100 to 110 days of feedlot finishing. Conclusions were that: (a) In a population of healthy feedlot cattle, a small subpopulation of animals appears



to become persistently colonized by closely related *E. coli* O157:H7 strains. (b) *E. coli* O157:H7 strains that persist in feedlot cattle are likely to do so because they are of molecular subtypes that demonstrate accentuated human-pathogenic potential, as shown by the enhanced ability of persistent strains to adhere to human intestinal epithelial cells. (c) These *E. coli* O157:H7 subtypes are transferred through the production continuum and subsequently into the human population because of their increased prevalence in feedlot cattle. (d) Preharvest food safety interventions must be identified to reduce the load of *E. coli* O157:H7 that enters the human food supply, and such efforts should be targeted at strains that persist in cattle populations — because they represent the greatest risk to human health. (e) Further research is needed to elucidate the underlying pathogen factors associated with persistent colonization of healthy cattle by *E. coli* O157:H7, including work to further probe molecular mechanisms associated with enhanced adhesion to cattle and human intestinal epithelial cells. (f) Mitigation strategies must be identified or developed to control *E. coli* O157:H7 in feedlot cattle populations with the ultimate goal of reducing the risk of human infection. ■

Researcher at Colorado State University<sup>2</sup> investigated the nature of *E. coli* O157:H7 colonization of feedlot cattle during the final 100 to 110 days of feedlot finishing. Conclusions were that: (a) In a population of healthy feedlot cattle, a small subpopulation of animals appears to become persistently colonized by closely related *E. coli* O157:H7 strains. (b) *E. coli* O157:H7 strains that persist in feedlot cattle are likely to do so because they are of molecular subtypes that demonstrate accentuated human-pathogenic potential, as shown by the enhanced ability of persistent strains to adhere to human intestinal epithelial cells. (c) These *E. coli* O157:H7 subtypes are transferred through the production continuum and subsequently into the human population because of their increased prevalence in feedlot cattle. (d) Preharvest food safety interventions must be identified to reduce the load of *E. coli* O157:H7 that enters the human food supply, and such efforts should be targeted at strains that persist in cattle populations — because they represent the greatest risk to human health. (e) Further research is needed to elucidate the underlying pathogen factors associated with persistent colonization of healthy cattle by *E. coli* O157:H7, including work to further probe molecular mechanisms associated with enhanced adhesion to cattle and human intestinal epithelial cells. (f) Mitigation strategies must be identified or developed to control *E. coli* O157:H7 in feedlot cattle populations with the ultimate goal of reducing the risk of human infection. ■

<sup>1</sup>Food Quality Newsletter (November 24, 2009) [foodquality@wiley.com](mailto:foodquality@wiley.com)

<sup>2</sup>Carlson *et al.* (2009) *Applied & Environmental Microbiology* 75:5927-5937.

For questions or comments about this article, email [gsmith@food-safetynet.com](mailto:gsmith@food-safetynet.com).

# New Products Allow Shorter Turnaround Times

By David Bosco, Regional Laboratory Manager

Traditionally, analysis for *Listeria* in food and environmental samples was a time consuming prospect, requiring long analysis times and creating unfavorable wait times for release of final results. Over the last 10 years, rapid technologies have been developed to detect the other food borne pathogens of paramount concern, such as *Salmonella* in less than 24 hours and *E. coli* O157:H7 in around 10 hours.

**So why has *Listeria* fallen behind?** To understand that, first you must understand how pathogens such as *Listeria*, *Salmonella*, and *E. coli* O157:H7 are analyzed in the laboratory.

When we receive a sample to be tested for a pathogen, regardless of the sample type, the first laboratory activity is enrichment. Due to advances in food processing and sanitation techniques widely used at the plant level, very few food or environmental samples have enough of the targeted pathogen present to be detectable by microbiological techniques. In order to grow the target organism to a detectable level, they must be enriched. The enrichment process involves mixing the sample with a nutritional broth to give the target bacteria all of its "favorite food," while excluding competitive bacteria from their "favorite foods." In the case of bacteria, favorite foods would consist of protein sources like digestion of

casein, specific sugars such as mannitol or sorbitol, salts and/or vitamins. The enrichment broths may also contain antimicrobial agents, antifungal agents or phages to help inhibit growth of competitive bacteria present in most samples. The blend of nutrients and antimicrobial agents used in each of the enrichment broths has been refined and optimized through years of microbiological research. After the sample has been mixed with enrichment broth, it is given time for the bacteria to eat, reproduce, and grow to a detectable level. The time for reproduction is called incubation time, and is done at very specific temperature ranges. The optimal temperature ranges have again been developed with years

of research, and just like the ingredients of the enrichment broth, serves as an inhibitory measure against competitive organisms which do not prefer that temperature.

One of the challenges to analyzing samples for *Listeria* comes from the temperature range and the behavior of the microorganism. *Listeria* is one of the slower growing pathogens, considered a psychotrophic, or cold loving organism. In order to facilitate the best growth of *Listeria* without allowing mesophilic, or moderate temperature loving organisms, to outgrow it, the incubation temperature for *Listeria* is lower than most pathogens. In order to allow *Listeria* to grow to detectable levels, it must be incubated

longer at the lower temperatures. Most of the rapid tests utilized in the lab for *Listeria* have a two-day turnaround of results, but traditional cultural methods for *Listeria* required week long incubations or more in some cases!

Today, manufacturers of rapid test assays have focused on *Listeria* with the intention of reducing the firm 48 hour turnaround, and consequently, there are now AOAC / AOAC-RI approved methodologies available for analysis of *Listeria* in 24 hours or less! We do not specifically endorse any particular product, but DuPont Qualicon, the manufacturer of the PCR-BAX system has a few options for detection of *Listeria* in around 24 hours or less, as does Bio-



# British Retail Consortium

By Jarrod Miller, Senior Auditing Specialist

Due to increasing customer demands, many processors have been required to adopt a new set of standards. These standards are an effort to bring the food safety systems, which have a multitude of different processors, in-line with one another. The standards are a comprehensive set of requirements that a facility must meet in order to be considered for certification. Standards include senior management commitment, food safety plan, food safety and quality management systems, site standards, product control, process controls, and personnel. Food Safety Net Services has chosen to become aligned with the British Retail Consortium.

The British Retail Consortium (BRC) is one of the leading trade groups in the United Kingdom representing retailers of all sizes. BRC was founded in 1992 when the British Retailers Association merged with the Retail Consortium. The technical standards for food were developed in 1998 to be used to evaluate own brand food products for manufacturers. As the standards were widely accepted and utilized across Europe and the globe, the BRC released Packaging Standards (2002), Consumer Product Standards (2003), and BRC Global Storage and Distribution Standards (2006). Standards are revised and updated at least every three years.

For a plant to become certified against the standards, an audit is required. Each facility is audited against the standards

set forth by the BRC and consists of the monitoring the facility's corrective actions upon completion of the audit. Facilities may elect to certify all products it produces, or they may pick and choose specific categories, depending on their needs or the needs of their customers.



Food Safety Net Services currently offers third party certification audits against the BRC standards. The BRC Standard is currently one of the few options to become certified against the Global Standard for Food Safety. Our trained and experienced auditing staff is accredited in a multitude of categories including, but not limited to, red meat, poultry, further processed foods, produce, oils, and bakeries. To date, Food Safety Net Services has four fully certified auditors capable of meeting your certification needs. If you have any questions concerning our BRC audits or any other auditing needs, feel free to contact us. ■

*For more information, email Jarrod Miller at [jmiller@food-safetynet.com](mailto:jmiller@food-safetynet.com).*

Control Systems, with their GDS platform. Both systems use highly specific genetic reactions, previously unavailable in rapid food pathogen detection to jump start the detection, and avoid the long incubation times. Also, 3M Microbiology offers a Petrifilm product, AOAC-RI approved for use on environmental samples that gives a count of viable *Listeria* cells in as little as 27 hours after sampling. Depending on sample type and specific needs, Food Safety Net can offer guidance and run one of these test systems to complement your food safety program.

Total yeast and mold organisms are similar to *Listeria* in that they are psychotrophic.

They grow slowly in ambient temperatures, and at the elevated temperatures used to quickly grow bacteria, some yeasts and molds will not grow at all. Powerful antibiotics or acidulants are added to the growth media to restrict bacterial growth, which also slow down the growth of the yeast and molds, adding to the total time of incubation, which is typically five days. Since yeast and molds are not generally considered pathogenic, it is not as hard for customers to accommodate the five day turnaround; however, some processors use yeast and mold as criteria for release of finished products, quality indicators or react with recall if counts exceed their specifications. At any rate, the desire for

faster results is always on our minds, and a few systems can now provide this ability!

BioControl Systems offers the Simplate method which has been AOAC-OMA approved. With advanced reagents and design, this system provides yeast and mold results in 2-3 days. The Neogen Corporation also sells an AOAC approved membrane filtration system for yeast and mold which boasts results in two days. These systems both utilize more advanced preparation techniques to allow the yeast and mold organisms more advantage in growth, and allow the organisms to grow faster and cleaner than in traditional methods. The PCR-BAX system also has a product on the market for

qualitative detection of yeast and mold. Depending on your application and specifications / action levels, this system may be able to offer same day results.

FSNS does not endorse or make performance claims for any of the systems discussed; however, we are always looking for ways to better serve our customers, and would be happy to set-up a testing program for you or your customers utilizing one of these AOAC approved technologies. Please contact your local lab or sales representative for further details. ■

*For more information, email David Bosco at [dbosco@food-safetynet.com](mailto:dbosco@food-safetynet.com).*

## Implementation for the BRC Standard for Food Safety

The Global Standard for Food Safety, Issue 5, is published by the Retail British Consortium (BRC). Originally developed in the UK Retail Market, it has acquired world wide recognition as the framework for any business to produce a safe and quality product. This training will provide you with the necessary knowledge and information to implement the BRC Global Food Safety Standard, Issue 5, in your facility. It will specifically cover the following topics:



- Senior Management Commitment
- The Food Safety Plan – HACCP
- Food Safety / Quality Management System
- Site Standards
- Product Control
- Process Control
- Personnel

### 2010 Course Dates:

May 5–7; Stillwater, OK  
 May 11–13; San Antonio, TX  
 Aug 17–19; San Antonio, TX  
 Nov 9–11; San Antonio, TX

*Registration Fee: \$595.00 (2 day course),  
 \$795.00 (3 day course)*



## HACCP Training

Join us for this 2-day course – fully accredited by the International HACCP Alliance – taught by **Dr. Gary Smith** of Colorado State University and **Dr. Keith Belk**, Director of Scientific Affairs with Food Safety Net Services.

### 2010 Course Dates:

May 18–19; Fresno, CA  
 June 1–2; San Antonio, TX  
 July 13–14; Green Bay, WI  
 Sept 14–15 Grand Prairie, TX  
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*Registration Fee: \$695 per person*

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*For comments on this newsletter, please contact Wendy Harmon at 888.525.9788 or wharmon@food-safetynet.com.*

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