

## ECOLOGY OF PATHOGENS

### EVALUATION OF *LISTERIA INNOCUA* AS A SURROGATE FOR *LISTERIA MONOCYTOGENES* IN AEROSOL STUDIES (G. Zhang, L. Ma, and M. P. Doyle)

Airborne contamination of *Listeria monocytogenes* may be a contributing factor in disseminating *L. monocytogenes* in food processing plants. However, aerosol studies in such facilities have been limited by lack of a suitable surrogate microorganism for *L. monocytogenes*. The objective of the study was to investigate the potential of using *Listeria innocua* as a surrogate for *L. monocytogenes* in an aerosol study.

Five strains of *L. innocua* and 5 strains of *L. monocytogenes* labeled with jellyfish green fluorescent protein genes were used. The study was carried out at room temperature in a bioaerosol chamber (124 x 51 x 51 cm). *Listeria* cells were released into the chamber by a nebulizer at  $10^5$  and  $10^3$  CFU/L air. Two air flow conditions were used: no fan blowing after plates were opened, and continuous fan blowing throughout the entire 3-h experiment. Trypticase™ soy agar (TSA) plates, Oven Roasted Breast of Chicken, and Oven Roasted Breast of Turkey in Petri plates were placed in the chamber to monitor *Listeria* cell number changes in the aerosol. Plates with TSA, turkey meat or chicken meat were exposed for 30 minutes to aerosol. Every 30 minutes new plates were exposed. A single trial lasted 3 hours. TSA plates were incubated at 37°C for 24 h. Turkey and chicken breast meat were stomached and enriched overnight in University of Vermont broth at 30°C, and then streaked onto modified Oxford plates and incubated at 35°C for 24 h. GFP-labeled *Listeria* colonies on all plates were counted with Leica X-Cite® 120 Fluorescence Illumination System. Experiments were repeated in triplicate.

Results revealed that *L. monocytogenes* and *L. innocua* survived as well on chicken and turkey breast meat as on TSA plates. When only one *Listeria* colony was detected on TSA plates, turkey and chicken breast meat plates were usually *Listeria*-positive also. When there was no detectable *Listeria* on TSA plates, turkey and chicken breast meat plates were usually *Listeria*-negative. In two cases, the chicken breast meat purchased for this study was contaminated with *Listeria*; however, by counting the fluorescent colonies only, we were still able to obtain reliable data. Therefore, GFP-labeled bacteria enabled the enumeration of *Listeria* in the presence of environmental contaminants. During the three hours of experiments, air flow with or without fan activity did not have a significant effect on settling rates of aerosolized *L. monocytogenes* or *L. innocua*. Settling rates of aerosolized *L. monocytogenes* and *L. innocua* were similar under both air flow conditions and as detected by all three media used. These results indicate that *L. innocua* could be used as a surrogate for *L. monocytogenes* in an aerosol study.

### EFFECTS OF BILE SALTS ON GROWTH OF *LISTERIA MONOCYTOGENES*

(G. Anderson, S. Lambert, and M.A. Smith)

Pregnant women are susceptible to *Listeria* infection, and stillbirths can occur especially upon exposure during the third trimester. Studies in the Rhesus monkey suggest that persistence in the host GI tract may be an important determinant of subsequent systemic infection and stillbirths. The current study characterizes the effects of bile salts on growth of strains of *Listeria monocytogenes* and compares bile salt tolerance in these strains to that of *Listeria innocua*. All *Listeria spp.* grew vigorously in the presence of bile salts. Specific growth rates in the presence of bile salts, either 2 or 4%, were not different ( $p < .05$ ) from control growth rates which ranged between 0.95/h and 1.06/h. There were no significant differences among strains in specific growth rates in the absence or presence of bile salt. In contrast, lag times exhibited both dose and strain dependence. In 2% bile salt, lag time for *L. monocytogenes* strains 12443 and H9666 were  $0.29 \pm 0.12$  h and  $0.39 \pm 0.18$  h, respectively. In contrast, the lag time for *L. innocua* was significantly longer ( $0.80 \pm 0.13$  h). The same pattern of responses occurred for growth in 4% bile

salt. Lag differences resulted in strain dependent differences in net growth during 3.5 h culture in the presence of bile salts. Populations of *L. innocua* increased by 12.1 fold in 2% bile salts compared to 17.6 and 16.1 fold for *L. monocytogenes* 12443 and H9666, respectively. We conclude that pathogenic *Listeria* was less sensitive to bile salts than non-pathogenic *Listeria*.

**DEATH OF *SALMONELLA*, *ESCHERICHIA COLI* O157:H7, AND *LISTERIA MONOCYTOGENES*  
IN SHELF-STABLE, DAIRY-BASED, POURABLE SALAD DRESSINGS  
(L. R. Beuchat, J.-H. Ryu, B. B. Adler, and M. D. Harrison)**

Commercial sterilization of salad dressings by treatment at high temperatures is not an option for eliminating microorganisms because it would destroy the physical integrity and result in products with substantially different sensory qualities. Commercial processing and preservation of salad dressings instead depends on a combination of intrinsic factors, and possibly mild heat treatments, to reduce, control, or eliminate microorganisms. Commercial salad dressings are also manufactured under strict quality controls, as manufacturers adhere to good manufacturing practices. Storage temperature can affect the physical stability and sensory quality of salad dressings, as well as the rate of growth of spoilage microorganisms. The lethality of the harsh environment imposed by intrinsic factors characteristic of salad dressings to foodborne pathogens that may become contaminants during postprocess handling would be anticipated to act synergistically or additively with non-refrigerated temperatures to cause death of these pathogens at a more rapid rate. The amounts and types of pourable salad dressings available for purchase in large containers for use in food service and home settings have increased in recent years. This presents an increased possibility of postprocess contamination, e.g., at salad bars where portions are removed from the same container by several different people over an extended period of time. The behavior of *Salmonella*, *E. coli* O157:H7, and *L. monocytogenes* that may contaminate salad dressings at some point after opening containers in foodservice or home settings has not been critically evaluated.

The objectives of this study were to determine the death rates of *Salmonella*, *Escherichia coli* O157:H7, and *Listeria monocytogenes* in three commercially manufactured full-fat ranch salad dressings, three reduced-fat ranch salad dressings, two full-fat blue cheese salad dressings, and two reduced-fat blue cheese salad dressings and to affirm the expectation that these dressings do not support the growth of these pathogens. The respective initial pH values of the four types of shelf-stable, dairy-based, pourable dressings were 2.87 - 3.72, 2.82 - 3.19, 3.08 - 3.87, and 2.83 - 3.49. Dressings were inoculated with low (2.4 - 2.5 log<sub>10</sub> CFU/g) and high (5.3 - 5.9 log<sub>10</sub> CFU/g) populations of separate five-strain mixtures of each pathogen and stored at 25°C for up to 15 days. Regardless of the initial inoculum population, all test pathogens rapidly died in all salad dressings. *Salmonella* was undetectable by enrichment (<1 CFU/25-ml sample in three replicate trials) in all salad dressings within 1 day, and *E. coli* O157:H7 and *L. monocytogenes* were reduced to undetectable levels by enrichment between 1 and 8 days and 2 and 8 days, respectively. *E. coli* O157:H7 was not detected in four of the ten salad dressings stored for 2 or more days and nine of the ten dressings stored for 6 or more days after inoculation. *L. monocytogenes* was detected in nine of the ten salad dressings stored for 3 days but in only one dressing, by enrichment, at 6 days, indicating that it had the highest tolerance among the three pathogens to the acidic environment imposed by the dressings. Overall, the type of dressing (i.e., ranch vs. blue cheese) and level of fat in the dressings did not have a marked affect on the rate of inactivation of pathogens. Total counts and populations of lactic acid bacteria and yeasts and molds remained low or undetectable (< 1.0 log<sub>10</sub> CFU/ml) throughout the 15-day storage period. Based on these observations, shelf-stable, dairy-based, pourable ranch and blue cheese salad dressings manufactured by three companies and stored at 25°C do not support the growth of *Salmonella*, *E. coli* O157:H7, and *L. monocytogenes* and should not be considered as potentially hazardous foods (time/temperature control for safety foods) as defined by the U.S. Food and Drug Administration Food Code.

**SURVIVAL AND GROWTH OF *ENTEROBACTER SAKAZAKII* ON FRESH-CUT FRUITS AND VEGETABLES  
AND IN UNPASTEURIZED JUICE AS AFFECTED BY STORAGE TEMPERATURE**  
(H. Kim and L. R. Beuchat)

In recent years, the incidence of foodborne diseases associated with fresh produce has increased. During the decade preceding 1999, approximately 12% of foodborne illnesses in the U. S. have been linked to fresh fruits and vegetables. Bacteria belonging to the family Enterobacteriaceae have caused or been associated with outbreaks of foodborne illnesses implicating unpasteurized juice and fresh fruits and vegetables. Examples of these outbreaks include *Escherichia coli* O157:H7 infection linked to the consumption of lettuce and apple cider, salmonellosis linked to tomatoes and cantaloupe, and shigellosis linked to parsley. Outbreaks of *E. sakazakii* infections associated with fresh produce have not been documented. However, isolated *E. sakazakii* has been isolated from 8 out of 9 food factories and from 5 out of 16 households, and the organism has been isolated from lettuce and other vegetables. Because of its presence in the environment, there is a risk of contamination of fresh produce with *E. sakazakii*. Its ability to grow at temperatures as low as 5.5°C raises concern about survival and growth on fresh-cut produce and in unpasteurized juice at storage temperatures used at retail and in food service and home environments.

We did a study to determine the survival and growth characteristics of *E. sakazakii* on fresh-cut apple, cantaloupe, strawberry, watermelon, cabbage, carrot, cucumber, lettuce, and tomato and in juice prepared from these fruits and vegetables. Produce and juice were inoculated with *E. sakazakii* at populations of 2 - 3 log<sub>10</sub> CFU/g and 1 - 2 log<sub>10</sub> CFU/ml, respectively, and stored at 4, 12, or 25°C. Populations did not change or gradually decreased in fresh-cut produce and juice stored at 4°C but grew on fresh-cut apple, cantaloupe, watermelon, cucumber, and tomato and in all juices except apple, strawberry, cabbage, and tomato juice at 12°C. All fresh-cut fruits and vegetables except strawberry supported growth of *E. sakazakii* at 25°C. Growth occurred in all juices except apple, strawberry, and cabbage juice, followed by decreases in population to < 1 CFU/ml after 48 - 72 h, which coincided with decreases in pH and an increase in population of lactic acid bacteria. Increases in total counts occurred in all juices except strawberry juice stored at 25°C and apple and strawberry juice stored at 12°C. Total counts increased in cantaloupe, carrot, cucumber, and lettuce juice stored at 4°C. Populations of molds and yeasts increased in apple and tomato juice stored at 25°C but decreased to < 1 CFU/ml in cabbage, lettuce, and cucumber juice. Further characterization of the behavior of *E. sakazakii* on fresh produce and in unpasteurized juice as affected by commercial packaging and handling practices is warranted.

**SURVIVAL AND GROWTH OF *ENTEROBACTER SAKAZAKII* IN INFANT RICE CEREAL  
RECONSTITUTED WITH WATER, MILK, LIQUID INFANT FORMULA OR APPLE JUICE**  
(G. M. Richards, J. B. Gurtler, and L. R. Beuchat)

Documented cases of infection caused by *Enterobacter sakazakii* are rare, although they have been more frequent during the past two decades. The bacterium has been implicated most often in causing illness in preterm neonates, infants and children from 3 to 4 years of age, with at least 76 cases and 19 deaths of infants being reported. Cases of *E. sakazakii* infections in adults also have been reported. Conditions affecting survival and growth of *E. sakazakii* in reconstituted infant formulae have been described. Minimum growth temperatures were reported to be 5.5 - 8.0°C. Guidance and recommendations concerning control and elimination of *E. sakazakii* in powdered infant formulae and reconstituted formulae have been issued in a joint report by the Food and Agriculture Organization/World Health Organization. Reports that *E. sakazakii* has been isolated from rice and rice products and that infants and young children have been diagnosed with infection caused by the bacterium raises concern about its behavior in reconstituted infant cereals.

We undertook a study to determine the survival and growth characteristics of *E. sakazakii* in infant rice cereal reconstituted with various liquids. The influence of storage temperature on survival and

growth was determined. A commercially manufactured dry infant rice cereal was reconstituted with water, apple juice, milk, or liquid infant formula, inoculated with a 10-strain mixture of *E. sakazakii* at populations at 0.27, 0.93, and 9.3 CFU/ml, and incubated at 4, 12, 21, or 30°C for up to 72 h. Growth did not occur in cereal reconstituted with apple juice, regardless of storage temperature, or in cereal reconstituted with water, milk, or formula and stored at 4°C. The lag time for growth in cereal reconstituted with water, milk, or formula decreased as the incubation temperature (12, 21 and 30°C) was increased. Upon reaching maximum populations of 7 - 8 log<sub>10</sub> CFU/ml, in some instances populations decreased to nondetectable levels during subsequent storage which was concurrent with decreases in pH. *Enterobacter sakazakii*, initially at very low populations, can rapidly grow in infant rice cereal reconstituted with water, milk, or infant formula. Reconstituted infant rice cereal can support luxuriant growth of *E. sakazakii*. Reconstituted cereal that is not immediately consumed should be discarded or stored at a temperature at which *E. sakazakii* and other food-borne pathogens cannot grow.

**ATTACHMENT OF *SALMONELLA* POONA TO CANTALOUPE RIND AND STEM SCAR TISSUES  
AS AFFECTED BY TEMPERATURE OF FRUIT AND INOCULUM**  
(G. M. Richards and L.R. Beuchat)

Surveys conducted by the U.S. Food and Drug Administration revealed that rinds of 7.3% of imported cantaloupes and 4.3% of domestically grown cantaloupes were positive for *Salmonella* or *Shigella*. Numerous national and international outbreaks of salmonellosis have been epidemiologically linked to fresh cantaloupes. *Salmonella* Poona was the predominant serotype responsible for these outbreaks. Removal of field heat from cantaloupes is often accomplished by forced-air cooling; however, hydrocooling and top icing are methods also currently used in the industry to rapidly attain temperatures of 2 to 4°C. The extent of infiltration of water into fruits and vegetables is generally dependent on factors such as length of exposure time, magnitude of temperature differential, immersion depth, agitation, viscosity of the external environment, and size and number of portals leading to internal airspaces. A negative temperature differential (i.e., when the temperature of the fruit is higher than the temperature of the water in which it is immersed) theoretically enhances infiltration of water and any microorganisms it might contain. Infiltration of water and plant pathogens into tomatoes has also been shown to be influenced by time- and temperature-independent hydrostatic forces in addition to time-dependent temperature differential phenomena.

The effect of temperature differentials on infiltration of *Salmonella* into cantaloupe rind has been described. The objective of this study was to assess the effects of temperature differentials between cantaloupes and suspensions (both at 4 and 30°C) of *Salmonella* Poona on changes in fruit weight and populations of the pathogen recovered from rinds and stem scar tissues of Eastern and Western cantaloupes. The percent weight increase in Western cantaloupes was significantly greater ( $P \leq 0.05$ ) than that in Eastern cantaloupes for all cantaloupe and inoculum temperature combinations. *Salmonella* Poona attachment to or infiltration of Eastern but not Western cantaloupe rind is enhanced when the fruit is at 4°C, compared to 30°C immersed suspension. The number of *Salmonella* Poona cells removed from rind tissue of Western cantaloupes at 30°C was significantly less ( $P \leq 0.05$ ) than that recovered from rind tissues of cantaloupes at 4 or 30°C that were immersed in inoculum at 4°C. *Salmonella* Poona in immersion water can adhere to or infiltrate surface tissues of cantaloupes. The populations of *Salmonella* Poona recovered from stem scar tissues of Eastern and Western types of cantaloupes were not significantly ( $P > 0.05$ ) affected by cantaloupe and inoculum temperature combinations. Populations of cells adhering to or infiltrating various cantaloupe tissues are not dictated entirely by temperature differentials between fruits and immersion suspensions; rather, they apparently are also influenced by structures unique to surface tissues.

**INACTIVATION OF *SALMONELLA* IN MANURE-BASED COMPOSTS WITH VARYING C:N RATIOS**  
(M. C. Erickson, J. Liao, L. Ma, X. Jiang, and M. P. Doyle)

Composting is a process whereby organic matter is decomposed by microorganisms to generate a stable amendment that improves soil quality and fertility. To date, the primary criteria for ensuring the microbiological safety of composts have been adherence to narrowly defined time-temperature conditions. To expand the guidelines whereby inactivation of pathogens could be assured, this study sought to determine if the carbon:nitrogen (C:N) ratio or the presence of ammonium sulfate affects the inactivation of *Salmonella* spp. in cow manure-based compost mixtures. Evaluation of compost conditions on pathogen inactivation was conducted using a bioreactor system. The days to achieve non-detection of *Salmonella* spp. by enrichment culture was used as the endpoint. In addition to pathogen levels, pH and temperature were monitored at 4 locations within the bioreactor. Location within the bioreactor was not a significant variable affecting pathogen inactivation. Compost preparations with an initial C:N ratio of 20:1 required a maximum of 4 days of storage before *Salmonella* was not detected whereas 30:1 and 40:1 C:N preparations required up to 7 days of storage. Both 20:1 and 30:1 C:N preparations were characterized by a decrease in pH to 5.5-5.7 before pH values increased to > 8. In contrast, pH values of 40:1 C:N preparations increased immediately to > 8, generally within the first day of storage. Maximum temperatures encountered in 20:1 C:N preparations for inactivation of pathogens were less than 50°C. Consequently, the cumulative heat exposure required for pathogen inactivation in 20:1 C:N preparations was five-fold less than in 40:1 C:N preparations. Temperatures within preparations supplemented with 0.08% ammonium sulfate were higher than unsupplemented preparations during the first 2 days of storage, however; these higher temperatures did not consistently translate into more rapid rates of pathogen inactivation.

**POTENTIAL ROLE OF *DIPLOSCAPTER* SP. STRAIN LKC25, A BACTERIVOROUS NEMATODE FROM SOIL, AS A VECTOR OF FOOD-BORNE PATHOGENIC BACTERIA TO PREHARVEST FRUITS AND VEGETABLES**  
(D. S. Gibbs, G. L. Anderson, L. R. Beuchat, L. K. Carta, and P. L. Williams)

Studies have shown that *Caenorhabditis elegans* is attracted to and ingests food-borne pathogens. A related free-living nematode found more commonly in the rhizosphere of agricultural soils is *Diploscapter*, several species of which are reported to be present in a range of agricultural habitats. Agricultural practices involving the use of compost, manure, and poorly treated irrigation water result in increased numbers of nematodes, but the behavior of *Diploscapter* in soil environments and their ability to feed on food-borne pathogens have not been described. The feeding behavior and reproductive cycles of *Diploscapter* and other free-living nematodes render them potential vectors for transporting and dispersing pathogenic bacteria in agricultural soil environments.

The primary objectives of this study were to determine survival and reproduction characteristics of *Diploscapter* nematodes fed on foodborne pathogenic bacteria; to determine if *Diploscapter* is attracted to pathogenic bacteria; and to determine if pathogenic bacteria ingested by *Diploscapter* or adhering to the worms in soil are subsequently shed and dispersed. A thermotolerant, free-living soil bacterial-feeding *Diploscapter* sp. commonly found in compost, sewage, and agricultural soil in the United States was studied to determine its potential role as a vehicle of *Salmonella enterica* serotype Poona, enterohemorrhagic *Escherichia coli* O157:H7, and *Listeria monocytogenes* in contaminating preharvest fruits and vegetables. The ability of *Diploscapter* sp. strain LKC25 to survive on agar media, in cow manure, and in composted turkey manure and to be attracted to, ingest, and disperse foodborne pathogens inoculated into soil or a mixture of soil and composted turkey manure was investigated. Attraction of *Diploscapter* sp. strain LKC25 to colonies of pathogenic bacteria on tryptic soy agar within 10, 20, 30, and 60 min and 24 h was determined. At least 85% of the worms initially placed 0.5 to 1 cm away from bacterial colonies migrated to the colonies within 1 h. Within 24 h,  $\geq 90\%$  of the worms were embedded in colonies. The potential of *Diploscapter* sp. strain LKC25 to shed pathogenic bacteria after exposure to bacteria inoculated into soil or a mixture of soil and composted turkey manure was investigated. Results indicate that *Diploscapter* sp. strain LKC25 can shed pathogenic bacteria after exposure to pathogens in these milieus. They also demonstrate its potential to serve as a vector of foodborne pathogenic bacteria in

soil, with or without amendment with compost, to the surface of preharvest fruits and vegetables in contact with soil.

**CONTAMINATION OF COMMERCIAL BROILER BREEDER ROOSTERS BY  
*CAMPYLOBACTER*, *SALMONELLA*, AND *CLOSTRIDIUM PERFRINGENS***

(N. A. Cox, C. L. Hofacre, R. J. Buhr, J. L. Wilson, J. S. Bailey, L. J. Richardson,  
D. E. Cosby, M. T. Musgrove, K. L. Hiett, and S. M. Russell)

The present study was conducted to determine if several foodborne pathogens (*Campylobacter*, *Salmonella*, and *Clostridium perfringens*) could be isolated from the ductus deferens, testes, and ceca of 45- to 65-wk old commercial broiler breeder roosters. Aseptic necropsy was performed on 15 roosters (five roosters from 3 separate commercial breeder farms) to remove the ductus deferens, testes, and ceca without surface contamination from blood and other tissues. None of the foodborne pathogens were isolated from the testes of the roosters. In the ductus deferens, *C. perfringens* was isolated from 1 of the 15 roosters, whereas no *Campylobacter* or *Salmonella* was isolated from this tissue. *Campylobacter* was cultured from the ceca of all 15 roosters, *C. perfringens* was isolated from 14 of 15 roosters, and *Salmonella* from 2 of 15 roosters. These data suggest that the contamination of semen by these foodborne pathogens is via fecal or cecal contamination as the semen passes through the cloaca and not from bacterial colonization of the testes and ductus deferens.

**INTESTINAL COMMUNITY STRUCTURE OF CHICKENS  
IN RESPONSE TO ORALLY ADMINISTERED TETRACYCLINE**

(A. S. Fairchild, J. L. Smith, U. Idris, J. Lu, S. Sanchez, L. B. Purvis, C. Hofacre, and M. D. Lee)

Tetracyclines are common therapeutic antibiotics used in poultry production. This study sought to evaluate the effects of oral administration of tetracyclines on the resistance of poultry commensal bacteria and the intestinal bacterial community structure. The diversity indices calculated from terminal restriction fragment length polymorphism analysis of 16S rRNA amplicons did not indicate significant changes in the cecal bacterial community in response to oxytetracycline. *Enterococcus* spp. and *E. coli* expressed tetracycline MICs of >8 µg/ml and harbored a variety of *tet* resistance determinants regardless of the tetracycline exposure history of the birds. The enterococcal isolates possessed *tetM* (61%), *tetL* (25.4%), and *tetK* (1.3%), as well as *tetO* (52.5%), the determinant known to confer a tetracycline resistance phenotype in *Campylobacter jejuni*. *E. coli* isolates harbored *tetA* (32.2%) or *tetB* (30.5%). Tetracycline MICs remained at < 2 µg/ml for *Campylobacter* isolates before and after tetracycline treatment of the chickens, even though isolates expressing MICs of >16 µg/ml were commonly cultured from flocks that did not receive oxytetracycline. The results imply that complex ecological and genetic factors contribute to the prevalence of antibiotic resistance arising from resistance gene transfer in the production environment.

**RESIDENT POPULATIONS OF ENTEROCOCCI ON POULTRY FARMS  
IN RESPONSE TO ANTIMICROBIAL USAGE**

(A. L. Debnam, C. R. Jackson, G. E. Avellaneda, J. B. Barrett, and C. L. Hofacre)

Enterococci isolated from four poultry houses during six grow-outs was determined. In two houses, flavomycin, virginiamycin, and bacitracin were used during different poultry grow-outs, whereas the other two houses did not use any antimicrobials. Of the nine species of *Enterococcus* isolated (*Enterococcus faecalis*, *E. faecium*, *E. avium*, *E. casseliflavus*, *E. cecorum*, *E. durans*, *E. gallinarium*, *E. hirae*, and *E. malodoratus*), *E. faecalis* was isolated most frequently from chick boxliners and carcass rinses whereas *E. faecium* was the most frequent isolate in litter and feed. *E. faecalis* and *E. faecium* was

isolated most often from the farm and houses, regardless of antimicrobial treatment, indicating that antimicrobial usage had no effect on the resident population of enterococci.

**CONTAMINATION OF INTERNAL ORGANS BY *CAMPYLOBACTER JEJUNI* FOLLOWING ORAL OR INTRACLOACAL INOCULATIONS OF BROILER CHICKS**

(N. A. Cox, C. L. Hofacre, J. S. Bailey, R. J. Buhr, J. L. Wilson, K. L. Hiatt, L. J. Richardson, M. T. Musgrove, D. E. Cosby, J. D. Tankson, Y. L. Vizzier, P. F. Cry, L. E. Vaughn, P. S. Holt, and D. V. Bourassa)

*Campylobacter jejuni* was administered to day-old chicks (n = 30) through oral and intracloacal inoculations. After inoculation, broilers were aseptically opened and internal organs (thymus, spleen, liver/gallbladder, bursa of Fabricius, and ceca) individually analyzed for *C. jejuni*. Overall, *C. jejuni* was isolated after oral inoculation from 13%, 17%, and 28% of the 1-h, 1-day, and 1-wk samples, respectively. Following the intracloacal route of inoculation, *C. jejuni* was recovered from 32%, 8%, and 16% of the 1-h, 1-day, and 1-wk samples, respectively. *C. jejuni* was isolated from 10%, 8%, 19%, 25% and 40% of the thymus, spleen, liver/gallbladder, bursa of Fabricius, and ceca samples, respectively. The rapid movement of *Campylobacter* to internal organs following both oral and intracloacal inoculation may be significant, particularly if it persists in these organs as reservoirs throughout the 65-wk life cycle of breeding birds.

