

# Keynote Address

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## The Role of Bovine Practitioners in Assuring the Safety of Beef

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According to TRENDS—1994 (TRENDS IN THE UNITED STATES—Consumer Attitudes And The Supermarket 1994; Food Marketing Institute, 1994), the top five food selection concerns and the percentages of the shopping public that considered these factors “Very Important” in food selection were as follows: (1) Taste, 90%; (2) Nutrition, 76%; (3) Price, 70%; (4) Product Safety, 69%; and (5) Storability, 41%. Interestingly, worry about product (food) safety seems to be declining inasmuch as this issue ranked second in importance in food selection concerns in 1988 (83%) and fourth in importance in 1993 (72%) and 1994 (69%) in TRENDS reports for those respective years (Food Marketing Institute, 1988, 1993, 1994). Even so, if nearly 7 of 10 food shoppers think food safety is “Very Important,” assuring the safety of its products is an economic imperative to those involved in beef production.

In response to the question “As far as you personally are concerned, on whom do you rely most to be sure that the products you buy are safe?” the shopping public (TRENDS—1994; Food Marketing Institute, 1994) responded as follows: (a) Yourself, as an individual, 39%; (b) Manufacturers, 21%; (c) Government, 21%; (d) Retailers (food stores), 7%; (e) Consumer Organizations, 6%; (f) All/Everybody, 4%; (g) Farmers, 1%; and, (h) Not Sure, 1%. In an article entitled “Who’s Responsible For Food Safety?” (Broiler Industry; August 1994), Anne Banville cites results of a poll of 157 newspaper editors by CMF&Z Public Relations to say the public puts the heaviest responsibility on the U.S. government (88%) with food processors ranking second (73%), supermarkets ranking third (62%) and producers ranking fourth (61%). Within the context of “producers,” you and I

would include veterinarians—specifically, for beef, bovine practitioners—and it is to the issue of producer accountability and specifically to the role of the bovine practitioner in such accountability that this discussion is directed.

It is encouraging that results of a February 1995 poll conducted by Peter D. Hart Research (according to a report in the April 1995 Issue of The Beef Brief by the National Cattlemen’s Association) revealed that 82% of “thought leaders” expressed confidence in beef’s safety and wholesomeness. In the Peter D. Hart Research report, these “opinion-leaders” and “consumer-influencers” assigned cattlemen mean scores or grades of “B minus” for “Providing safe beef, free of chemicals and pesticides” and of “B average,” for “Providing beef free of bacterial contamination.” The National Cattlemen’s Association, citing the latter research report, concluded that the safety of U.S. beef is one reason why exports of U.S. beef have increased. The International Beef Audit, according to Morgan and co-workers at Colorado State University in 1995, surveyed beef purchasers in five regions of the world and observed that U.S. beef is the safest in the world, it has the world’s highest microbiological quality and it has the world’s lowest incidence of violative levels of chemical residues.

Mike Espy, then-Secretary of USDA, said in his keynote address to the Institute of Food Technologists in June 1994 (Food Technology, September 1994), “Yes, we in America have the safest food supply on the face of the earth, but I believe it can be made safer still. We know that *prevention* is the key to improving food safety, that *Hazard Analysis Critical Control Point* (HACCP) is universally recognized as the method (of prevention)

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that works, that there is support for strategies on industry-driven HACCP models at the *producer level* and that a truly effective overall strategy—a proactive one—that confronts pathogens (for example) at every stage of the production process, *starts on the farm.*”

The Animal Production, Technical Analysis Group (AP-TAG) of APHIS/FSIS USDA, in its Final Report (April 17, 1995), emphasized Hazard Analysis Critical Control Points as a significant component of preharvest food safety processes and concluded that—because of the complexity of the red-meat and poultry food chain—a functional food safety system must encompass the farm-to-fork concept within a framework of *shared responsibility from producer to consumer*. Dr. Robert L. Buchanan (FSIS/USDA) wrote in an article in Trends in Food Science & Technology (November 1990) that “an area of concern in implementing an ideal HACCP system is to have control over a product from the farm to the consumer, yet—in practice—neither manufacturers nor regulatory agencies have control of more than a small portion of the complete process.”

Possible food-safety concerns about beef include: (a) Presence on beef of food-borne pathogens (most important would be *Salmonella*, *Listeria monocytogenes*, *Campylobacter jejuni* and *Escherichia coli* O157:H7), (b) Residues, in beef, of pesticides (of either or both of the types—chlorinated hydrocarbons and organophosphates), (c) antibiotics (fear of residues of the antibiotics), in beef, and/or of development and presence, on beef, of antibiotic-resistant strains of human pathogens because of continued exposure of human pathogens—that have livestock hosts or vectors—to feed-grade antibiotics), and (d) Residues of livestock growth-promoting compounds in beef; concern is about the presence, in beef, of residues of naturally occurring growth-promotants (the hormones—estrogen, testosterone, progesterone) as well as of the chemically synthesized growth-promotants (the xenobiotics—trenbolone acetate, melengestrol acetate, zeranol).

Results of TRENDS—1994 (Food Marketing Institute, 1994) support the contention that the shopping public is concerned about presence of bacteria on red-meat (“spoilage,” “freshness,” “bacteria/contamination” and “spoilage/germs” were ranked first, second, seventh and eighth as food-safety threats) and about “pesticides/residues/insecticides/herbicides” (ranked third) but do not support a public-concern contention about “antibiotics” or “hormones” because neither was mentioned often enough to make the food-safety threats list. Results of the CMF&Z Public Relations survey (Broiler Industry, August 1994) said the food editors ranked “bacteria in food,” “food handling” and “pesticides in foods” as issues of the greatest food-safety concern to the public while “hormones” and “drug residues” in food were ranked of moderate concern.

Present thinking with regard to the food-borne pathogens is as follows: (a) to minimize occurrence of food-borne pathogen illness, industry must use Good Manufacturing Practices, Bacteriostatic/Bactericidal Rinses, HACCP Protocols and Consumer Education. (b) Even though the Centers For Disease Control, in 1994, attributed 77% and 20%, respectively, of food mishandling to mistakes made at food-service sites and in the home and only 3% of food mishandling to problems generated at processing plants, greatest emphasis must be placed on prevention—preventing occurrence of pathogens in and on cattle and preventing transfer of pathogens from cattle to carcasses during processing. (c) Council For Agricultural Science and Technology, in the September 1994 report “Foodborne Pathogens: Risks And Consequences” stated “Control methods affect specific pathogens and toxins differently; no one method will eliminate all pathogens and their toxins from the food chain. Pathogens or their toxins may be controlled by preventing their entry into the food, by reducing the amount present, or by destroying that which is present.” (d) Colorado State University scientists are presently studying “interventions” (treatments or procedures that will reduce bacterial counts on beef carcasses—like dehairing, rinsing with organic acids, spray-washing with 165°F water, steam-vacuuming, etc.) that could be sequentially applied or used in a “multiple hurdle” or “multiple intervention” strategy to lessen substantially the odds of *E. coli* O157:H7 or any other pathogen surviving the harvest and conversion process (from live animal to food product). For example, if the odds of finding *E. coli* O157:H7 on the surface of a beef carcass is 0.2% (1 in 500) and each of three intervention steps results in a decimal (log<sub>10</sub>) reduction in bacterial counts on the surface of a beef carcass, then the odds of finding *E. coli* O157:H7 on the surface of dehaired cattle, whose carcasses were washed—pre-evisceration—with acetic acid and—finally—with 165°F water, would be 1 in 500,000. USDA veterinary epidemiologist Dr. Dave Dargatz says the general theory behind the farm-to-table HACCP approach is that the consequences of good or poor management practices can be cumulative. As a part of the National “Cattle On Feed Evaluation,” Dr. Dargatz has collected feedlot prevalence data on the human pathogens *E. coli* O157:H7 and *Salmonella*. Based on fecal samples from 100 feedlots in the top 13 cattle feeding states, results show that 1.61% of the samples contained *E. coli* O157:H7 bacteria and that 63% of the feedlots had one or more positive samples. These results parallel findings from other studies of ranches and dairies, indicating that the pathogen has a low prevalence but that it is widespread.

John Maday, in a June 1995, Drovers Journal article (“Searching For Pathogen Control Points”) says: (a) If producers can minimize the prevalence of patho-

gens in live cattle, they lower the risk of microbes slipping through controls at the packer, processor, retailer and consumer levels, (b) Scientists are currently studying a hypothesis that fecal counts are higher in packer holding pens than in feedyards perhaps because of shipping stress and withdrawal of feed; if fecal shedding of *E. coli* O157:H7 increases just prior to slaughter, the potential for hide contamination also increases, and (c) Competitive exclusion, using probiotic cultures to reduce *Salmonellae* and *E. coli* O157:H7 or perhaps the feeding of ionophores, or maybe the introduction of therapeutic probiotic bacterial strains will show promise as means for controlling/eliminating pathogens in the feces of slaughter cattle.

Dr. Dale Hancock and Dr. Tom Besser of Washington State University have worked extensively to identify sources of *E. coli* O157:H7 and means for lessening/preventing occurrence of that pathogen in cattle. Dr. Besser, at an FSIS symposium in Chicago, Illinois on April 13, 1995, said: (a) *Trace-back* is not realistic because about 70 to 80% of farms, ranches and feedlots have cattle that are shedding *E. coli* O157:H7 and the organism is also shed by sheep and deer. (b) *Universal-testing* of all cattle going to slaughter is not realistic because about 1 in 40 slaughter cattle have *E. coli* O157:H7 in their gastrointestinal tract and many more (perhaps 10 times as many) cattle carry the organism on their hair than actually shed it in their feces. (c) *Farm visits* by FSIS or APHIS officials is not realistic inasmuch as not enough is known to allow government personnel to provide meaningful advice. (d) *Vaccination* is being studied but with not much promise of success. (e) *Preslaughter measures* such as elimination of preslaughter fasting and such as washing of live animals to remove feces and soil may prove efficacious for lowering the odds of finding pathogens on the outside of cattle. (f) *Competitive exclusion* or niche engineering—using probiotics in the feed and/or inoculating the rumen with “good” bacteria that will compete with pathogens—is probably the best approach for lessening occurrence of *E. coli* O157:H7 and other pathogens in and on slaughter cattle.

Food Chemical News (May 9, 1994) reported that long transportation times and holding times—then being reported by cattle packers—are stresses that might increase the potential for shedding and transmission of *E. coli* O157:H7 and *Salmonellae* from the gastrointestinal tracts of slaughter cattle. Bovine practitioners can be extremely helpful in the process of lessening/preventing occurrence of pathogens in and on cattle by carefully following/monitoring progress of research on antemortem aspects of etiology of these microorganisms and of keeping their clientele informed on management practices that might be helpful for protecting the public health.

At the 1995 meeting of the Institute of Food Tech-

nologists in Anaheim, California, Dr. Doug Archer (University of Florida) gave the Food Microbiology Division lecture and spoke of soil protozoa as potentially acting as “Trojan Horses” for pathogenic bacteria “shielding them from disinfectants, facilitating their travel, and influencing their virulence in humans” (IFT Abstract 34-1, 1995). According to Dr. Archer, we need to conduct research where the problems begin, which—according to him—is the farm. Understanding the microbial ecology at the farm level should help us deal with the problem of pathogen contamination in foods. Preliminary studies need to be conducted at the feedlot level to examine potential sources, and niches for the pathogen *Escherichia coli* O157:H7. According to Dr. Archer, pathogens try to survive under the adverse conditions of the farm and develop resistances as well as niches for their survival. One such niche for this pathogen may be the water troughs or other standing waters areas in feedlots or in farms. In addition, a potential decrease in the acidity of the rumen, as well as protection by protozoa, may allow survival of *E. coli* O157:H7 and contamination of the meat. Studies need to be conducted to examine these hypotheses; if such theories are substantiated, producers and bovine practitioners must work together to alleviate problems.

Because it is so difficult (and so extraordinarily expensive) to try to find food-borne pathogens on or in beef by use of sampling protocols, the only rational approach to lowering incidence of, and lessening the odds of encountering, food-borne pathogens like *E. coli* O157:H7, is to use every piece of science and technology that we can muster to prevent the organism from being present on the animal at the time it is presented for slaughter and to intervene (to wound or kill the pathogens) in some sequential, multiple-hurdle application of bacteriostatic/bactericidal technology. If any element or sector of the beef industry is essential for understanding “prevention” at the live animal level and for assuring that the necessary preclusionary actions are taken, it is the bovine practitioner—working with the production sector—who will be able to assist in this regard.

Each year, the National Residue Program of the Food Safety and Inspection Service of the U.S. Department of Agriculture releases results of its nationwide residue monitoring efforts in U.S. meat and poultry. The National Residue Program of the USDA in 1993 tested for 42 chemicals in 8 classes of animal drug and pesticide compounds. FSIS/USDA, in announcing results for FY-1993 (in November 1994), said, “Only 0.26% of the 39,128 samples of livestock and poultry meats tested in 1993 by FSIS/USDA during our domestic routine residue-monitoring program showed illegal levels (violative concentrations) of pesticide, hormone, antibiotic, drug and other chemical residues, down from 0.29% in the 1992 samples and the same—0.26%—as that in the 1991 samples.”

There are some marketers who have tried to position "Natural" or "Organic" beef as superior to "Conventional" beef in terms of safety. FSIS/USDA does not report separately the residue monitoring results for samples from cattle raised under different management systems (i.e., "Natural," "Organic," "Conventional"). The Cattlemen's Beef Promotion and Research Board provided funds for determining the incidence of chemical residues in beef tissues to the National Live Stock and Meat Board, who awarded funding to conduct two such studies to the Center For Red Meat Safety at Colorado State University. Results of those two studies confirm (according to papers published in the *Journal of Muscle Foods* in 1994 and 1995 by Smith and co-workers) that beef is safe relative to the exceptionally low incidence of violative chemical residues. One of those studies, involving 80 samples of muscle, fat, liver and kidney from "Conventional," "Natural," "Organic" and "Realizer" (chronically ill) steers and heifers, as well as from "Cull (beef/dairy) Cows," detected no violative residues of five anabolic steroids, two heavy metals, three stress reducers, six thyrostats/sulfa-drugs and 25 chlorinated hydrocarbon and organophosphate pesticides. The second of those studies, involving muscle, fat, liver and kidney samples from "Conventional," "Natural" and "Organic" steers and heifers, detected zero violative residues in 558 tests for three anabolic steroids, zero violative residues in 558 tests for three xenobiotics, zero violative residues in 1,860 tests of ten sulfa-drugs/antibiotics and 15 violative residues (three in "Conventional" beef, six in "Natural" beef and six in "Organic" beef; all in liver samples and none in muscle, fat or kidney samples) in 4,650 tests for 25 chlorinated hydrocarbon and organophosphate pesticides. In a third study, conducted by the Center For Red Meat Safety in 1994 and reported to the sponsor (the National Live Stock and Meat Board) in 1995 by Schnell and co-workers of Colorado State University, muscle tissue from cattle finished on diets containing fruits, vegetables and/or their byproducts did not contain significant pesticide residues; only 10 out of a total of 275 samples of feed and animal tissue tested for ten oncogenic—according to EPA—pesticides had any detectable pesticide residues. Eight of those 10 positive samples (all 8 of those tissue samples contained benomyl) had levels of benomyl well below, or at, the tolerance allowed in plant products or in beef adipose tissue while two feed samples (the other 2 of the 10 positive samples) from the Control group (not fed fruits, vegetables or their byproducts) contained cypermethrin levels above those permitted in beef adipose tissue.

Data from the studies conducted by the Center For Red Meat Safety reveal exceptionally low incidence of violative chemical residues in U.S. beef produced under "Conventional" production/management conditions; there were no violative residues of anabolic steroids (es-

trus suppressants; growth promotants), xenobiotics (growth promotants), heavy metals (environmental contaminants), stress reducers (tranquilizers), thyrostats/sulfa-drugs (growth promotants; health aids), beta-lactams (health aids), or tetracyclines (health aids). In one of the CSU studies in which violative residues occurred, the residues were of pesticides, and the highest incidence was in livers from beef cattle produced under "Natural" (six of 1,575 tests; 0.38%) and "Organic" (six of 1,575 tests; 0.38%) management conditions; the only violative residues of any chemical found in these latter studies were in livers and not in meat.

While incidence of violative residues of chemicals has been, and remains, very low in slaughter steers/heifers, in their carcasses and in their offal (as a result, I believe, of the diligence of feedlot operators and their colleagues, especially bovine practitioners, in efforts to assure the safety and wholesomeness of beef), the incidence of violative residues of antibiotics and sulfa-drugs in cull cows and calves is of concern. Results of the 1993 FSIS/USDA, National Residue Program, Domestic Residue Monitoring reveal that there were 0, 0, 5 and 14 violative residues of antibiotics in analyses of 333 steer, 344 heifer, 931 cow and 1,637 calf samples, respectively, and 0, 0, 4 and 12 violative residues of sulfa-drugs in analyses of 338 steer, 348 heifer, 933 cow and 1,635 calf samples, respectively.

A descriptive review of 1,100 Establishment Inspection Reports for FY-1992 (as reported by Dr. Bert Mitchell of CVM, FDA at the World Congress on Meat Inspection in October 1993) collected by FDA for tissue residue violations (following-up on 4,325 residue violations detected by STOP, CAST or NRP monitoring and surveillance by FSIS/USDA) revealed the following: (a) Residues were most often associated with use of penicillin (17%), sulfamethazine (13%), streptomycin (10%), oxytetracycline (7%), tetracycline (6%), gentamycin (4%) and neomycin (2%). (b) Of residue violations, 45.3% were in dairy cows and 40.0% were in bob veal, (c) Route of administration for residue violations in 46% of cases was via injection as compared to 29% for oral, 7% for intramammary and 18% unknown, (d) The most frequently cited practices that lead to residue violations were failure to adhere to withdrawal times (46%), extra-label use of drugs by producers (5%), and failure to maintain records (5%), (e) Where attempts to assign responsibility could be made, in 863 reports in 1992, the person identified as the responsible party for the residue violation was a producer 76% of the time, a veterinarian in 1% of the cases, a buyer/dealer in 1% of occasions, and could not be determined in 22% of the circumstances. **The latter findings provide additional evidence suggesting that bovine practitioners—working in close concert with those in the production/management sector—**

**could dramatically lower the incidence of violative chemical residues in beef and, in so doing, could help assure continuing safety of beef.**

Dr. William R. Van Dresser (AVMA Government Liaison) in a paper entitled "Food Safety And The Food Animal Veterinarian: What You Need To Know" in the January 1991 edition of The AABP Proceedings, made the following remarks: **"Animal drug residues in meat and milk must be a concern of every bovine practitioner and must remain so as long as residues are present. The veterinary profession must play an active role in the solution of the problem. Veterinarians possess the required scientific knowledge and the commitment to food safety. If we are to remove the food safety issue from the consumer activist and from the congressional agenda and avoid the ever increasing control and regulation of our profession, each food animal practitioner must accept his responsibility in obtaining a residue-free food supply"** (Van Dresser, 1991).

In a May 1995 article in *Drovers Journal* entitled "Expanding The Role Of Consultants," Dr. Louis Perino of the Great Plains Veterinary Education Center identified five areas in which feedyards can expand their relationships with consulting veterinarians; these are: (1) information management, (2) quality assurance, (3) education, (4) occupational health and worker safety, and (5) environment. Under "quality assurance," Dr. Perino discusses "assuring quality at all levels" and mentions—specifically—implants, vaccinations and other treatments. To this could be added "safety assurance" with the implication that proper administration and withdrawal of all drugs, vaccines, antibiotics, etc., should also fall under the purview of the consulting veterinarian.

According to Dr. Tari Kindred in a 1993 article entitled "Residue Prevention Strategies In The United States" in the *Journal of the American Veterinary Medical Association*, "Although the government-sponsored National Residue Program (in the late 1970s) generated considerable awareness of the problem, it was the producer organizations that ultimately took the lead in

promoting residue prevention on the farm. Livestock producer organizations, assisted by veterinarians and government officials, translated our knowledge into quality assurance (QA) programs aimed at reaching their respective producer members. The most noteworthy new feature of the producer-generated QA programs is the requirement that a valid veterinarian/client/patient relationship exists. Today, veterinarians are in QA programs involving pork, milk, dairy beef, feedlot cattle and veal. **Violative residues are preventable, and the veterinary profession needs to emphasize residue prevention."**

In conclusion, bovine practitioners can, and must, play an increasingly greater role in assuring the safety of beef. With regard to lessening the incidence of bacterial pathogens—in general—in and on beef, bovine practitioners can do little—beyond insisting on use of sanitary and hygienic practices to keep cattle "clean" prior to slaughter. Because so little is presently known regarding the etiology of the ailments associated with presence/activity of *E. coli* O157:H7 in host animals, bovine practitioners can do little more than wait—but with an ear to the ground—until enough definitive information is available to allow them to provide advice to the production sector that will enable producers to lessen the occurrence of that pathogen on cattle at the time they are presented for slaughter. With regard to lessening the incidence of violative chemical residues—of pesticides, antibiotics, drugs and growth promotants—bovine practitioners have been, and must continue to be, vital elements and full partners in the industrywide commitment to assuring the safety of beef. The bovine practitioner is uniquely qualified and perfectly positioned to play a vital role in assuring the safety of beef; required for success will be continued commitment on the part of the bovine practitioner to accept responsibility for that role. **Past experience argues strongly that if cattle producers will allow them opportunity to do so, practicing veterinarians can improve the "bottom line" and protect the public health... simultaneously.**