within a cell. Analysis of these data provide a crude estimate of gene networks, and these may prove to be of some interest to future breeders. Finally, an old tool from evolutionary genetics, Burns-Kascer sensitivity analysis for flux through biochemical pathway, is discussed. In conjunction with hopefully forthcoming data on gene and protein networks, sensitivity analysis may provide breeders with a powerful analytic approach to detect key points in pathways of interest. Knowledge of such points obviously serves a starting point for searches for useful genetic variation in traits of interest.

**Key Words:** Microarrays, Protein-protein interaction networks, Burns-Kascer sensitivity analysis

## Food Safety Symposium: Food safety for animal agriculture: What producers need to know

### 20 Animal and egg production food safety: Introduction.

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An on-farm food safety program has been developed for Extension specialists and agents and other food animal professionals to use for their own information or in developing educational programs for animal producers. The program consists of modules on various topics related to food safety, a database with selected references, and links to other food safety related websites and is available on CD-ROM through the ADDS Center. Its development and distribution was funded by USDA Food Safety and Inspection Service. Oversight was provided by a steering committee that included Extension agents and specialists representing food science, veterinary medicine, and animal and poultry science. Modules discuss importance of food safety and use of HACCP in development of quality assurance production practices. Specific modules include: causes of foodborne disease, drug use, residues, and resistance, HACCP, management practices that also involve feeds, and control of flies and rodents, farm advisory teams, and commodity assurance programs for aquaculture, beef, chick and poultry, egg, turkey, dairy, goat, veal, pork, and sheep. Primary emphasis was given to commodity programs. The modules and database were evaluated by the animal science committee of the National Association of County Agricultural Agents and the steering committee.

**Key Words:** Animal production food safety, Training/teaching modules, Extension education

### 21 Food safety for animal agriculture: What producers need to know about causes of foodborne illness.

D. B. Griffin*, *Texas A&M University, College Station, TX.*

This module reviews CDC foodborne disease incidence, types of foodborne illness and prevalence, trends in causes of foodborne illness over past century, symptoms and susceptibility, and specific pathogens and sources found in animal products using baseline data of USDA FSIS. Brief discussions are provided of: *E. coli, Salmonella, Staphylococcus aureus, Listeria, Campylobacter, Yersinia, Bacillus cereus, Clostridium botulinum, Giardia, Cryptosporidium*, and BSE. The relationship between *Mycobacterium paratuberculosis* and Johne's disease with Crohn's disease in humans is explored. The module outlines the roles of pasteurization and irradiation in preventing disease outbreaks.

**Key Words:** Animal production food safety, Foodborne illness, Extension education

### 22 Food safety for animal agriculture: What producers need to know about drug use, resistance, and residues.

B. Jayarao*, *Pennsylvania State University, University Park, PA.*

This module reviews uses of antibiotics in animal agriculture, extent of residues and causes, benefits of subtherapeutic drug use, antibiotic resistance and relation to drug use in food-producing animals, extra label drug use, and role of animal producers in minimizing risk. The module looks at the importance of antibiotics to animal production, while discussing why antibiotics are of concern to public health. It discusses the extent of drug residues, using USDA FSIS residue test results, and summarizes some of the causes and/or errors in drug use. Relationship between drug use in food producing animals and antibiotic resistance in humans is examined. Extra label drug use is defined and requirements for use are listed. The role of antibiotic susceptibility tests is outlined. The advantages of subtherapeutic (for growth promotion), prophylactic (disease prevention), and therapeutic (treatment of infections) antibiotic use in animals are presented as well as concerns over excessive use.

**Key Words:** Animal production food safety, Drug use, Extension education

### 23 Food safety for animal agriculture: What producers need to know about HACCP and management practices.

G. M. Jones*, *Virginia Tech, Blacksburg, VA.*

HACCP (hazard analysis critical control points) is a system that identifies specific hazards, implements effective control measures, and monitors procedures used to prevent hazards. It is a tool used to protect food against microbiological, chemical, and physical hazards. An illegal drug residue in milk or meat is a hazard. HACCP is a process that collects and analyzes information on hazards and conditions leading to their presence and to decide which are significant. Critical control points are the steps at which control can be applied and are essential to prevent or eliminate a food safety hazard or to reduce it to an acceptable level. Quality assurance programs are generally based on HACCP concepts and these are embedded in residue avoidance programs. HACCP includes keeping records to trace problems and to measure effects of intervention strategies and the monitoring of progress in controlling hazards. The HACCP module includes: definition/description, potential hazards and their significance, on-farm critical control points, corrective actions, role of quality assurance programs and their benefits, and brief introduction to various commodity Quality Assurance Programs. The management practices module includes sources of hazards and stressors on the farm, on-farm critical control points, animal health (immune system, nutrition, environment), management strategies and practices, biosecurity, transportation of animals, handling disabled animals, and dead animal disposal.

**Key Words:** Animal production food safety, HACCP, Management practices

### 24 Food safety for animal agriculture: What producers need to know about quality assurance programs.

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Virtually all food animal commodity organizations have implemented quality assurance education programs (QAP) to maintain or increase food safety, wholesomeness, and quality. The goal of all food animal industries is to produce high quality, safe products. QAP focus on helping producers supply products that are as free as possible of microbial hazards and drug and chemical residues, although QAPs originally focused on residue avoidance. Benefits of QAP include improved management practices, avoidance of violative drug residues, decreased production costs, and increased awareness of food safety concerns. QAPs are important because they: promote animal health and welfare, ensure proper drug and antibiotic use, provide records to assure purchasers of good production practices, are proven to reduce residue violations, potentially reduce pathogens through good hygiene and animal health, and improve production efficiency and quality of animals. QAPs take into consideration feedstuffs (additives, medications, mycotoxins, pathogens, clean mixing equipment), cleanliness and ventilation of facilities, appropriate drug use and records, extralabel drug use, identification and tracking of treated animals, injection site blemishes and hazards, and biosecurity. Self-review is important in QAPs, and some utilize third party verification. This module reviews basic concepts behind quality assurance programs, benefits, residue violations, drug withdrawal times, preharvest testing, sensitivities and specificities, false positive and false negative test results, and presents a brief introduction to commodity QAPs.

**Key Words:** Animal production food safety, Quality assurance programs, Extension education