642 Meat product safety. E. W. Mills*, *Pennsylvania State University, University Park*.

With an abundant and inexpensive food supply in the US consumer concerns for quality and safety have become preeminent. Rather than concern themselves with obtaining enough food, US consumers focus on perceived quality, safety and food production practices such as animal husbandry practices. Animal management practices such as confinement, castration, dehorning, use of antibiotics and growth promotants all come under criticism in the market place. The popularity of production claims such as organic, natural, and grass fed among others derives from a growing consumer desire to know more about how foods are produced. Such knowledge may lead to an increased perception that foods are safe and environmentally friendly. When consumers hear that millions of pounds of beef are being recalled they reasonably presume that this effort involves unsafe products. But, the idea that unsafe products are being withdrawn from commerce does not give consumers confidence that other products are safe. In fact, the occurrence of a recall leads, at least temporarily, to decreased consumer confidence in similar products which remain on the store shelves. Recently, in the peanut industry, a salmonella outbreak and recall by a small Georgia peanut processor has lead to a dramatic decrease in demand for a variety of peanut-containing products across the industry. Similar outcomes occur when meat or dairy products are recalled. There could be benefit throughout the food chain when consumers are better informed and understand what is going on during a recall. However, by the time you issue the recall news release you are already in the "minimize damage" mode. There is not much opportunity for positive spin or consumer education. Even if you have valid points to be made, your credibility is at its lowest when you are on the defensive. During a recall it is best to stick to the business at hand – retrieving product as efficiently as possible. Informing consumers about safety and wholesomeness of meat products and putting meat recalls into perspective is an ongoing task that we must pursue constantly.

Key Words: meat safety, product recall, consumer perceptions

CSAS Symposium: Functional Foods, Probiotics and Animal Health

643 Postnatal development of the mucosal immune system in domestic animals and consequences on health in adulthood. M. Bailey*, *University of Bristol, Bristol, U.K.*

In many mammalian species the immune system is poorly developed at birth. In the pig, the mucosal immune system is almost absent and develops over the first few weeks in conventional husbandry conditions. Sequentially, the intestine is populated by dendritic cells, CD4+ T-cells and CD8+ T-cells, while B-cell compartments firstly expand (Peyers patches) and then class-switch (to IgA). Much of this development is dependent on, or driven by, the presence of microbial flora in the intestine. Our observational studies have demonstrated that the complexity and type of microbial flora seems to depend on the genetics of the sows and piglets and on the environment (indoor, outdoor farms), and can be further manipulated by environmental modification (high-hygiene isolators). Similarly, there are marked differences in the rate of acquisition of memory T-cells between pigs on different farms, indicating environmental effects on immunological development. Consistent with these observational studies, direct manipulation of microbial flora in neonates using highly controlled conditions (caesarean-derived germ-free piglets reared in full gnotobiotic conditions and colonised with a defined, three-component flora) or conventional conditions (piglets fed a probiotic micro-organism from weaning) have also clearly demonstrated an impact of microbial flora on measures of immunological development and function. However, an important issue is the value, or otherwise, of such manipulations for subsequent 'enteric health' of the individual. The mucosal immune system is a complex, self-regulating system, capable of expression of active immune responses or tolerance directed at pathogens, commensals or food antigens. Manipulations directed at enhancing certain components may be advantageous under some circumstances but deleterious under others. Rational manipulation of early life flora will require considerably greater mechanistic understanding of the complexity of interactions between micro-organisms and the intestinal immune system.

Key Words: mucosal immunology, probiotics, neonate

644 Use of probiotics and prebiotics to modulate intestinal health in monogastric farm animals. M. Lessard*[1], X. Zhao[2], and F. Guay[3], [1]*Dairy and Swine Research and Development Centre, Agriculture and Agri-Food Canada, Sherbrooke, QC, Canada*, [2]*McGill University, Department of Animal Science, Montreal, QC, Canada*, [3]*Université Laval, Département des sciences animales, Quebec, QC, Canada*.

There is increasing evidence that probiotics and prebiotics have beneficial effects on animal health through their potential to modulate intestinal microbiota and interaction between bacterial populations and host intestinal defenses. Probiotics are well-defined bacteria or yeasts and their functional properties are strain specific. Among proposed mechanisms, probiotics have the potential to increase resistance to enteric infections by inhibiting growth of pathogenic bacteria. However, the most common purported benefits of the consumption of probiotics are associated with their potential to modulate barrier properties of the intestinal wall and host immunity. Prebiotics are non-digestible food ingredients such as inulin, fructo-oligosaccharides and mannan-oligosaccharides. They are fermentable and can stimulate the growth and/or the activity of commensal intestinal bacteria such as bifidobacteria or bind to pathogenic bacteria that contribute to health. To modulate intestinal barrier functions and immunity, probiotics and commensal bacteria must interact with epithelial cells and immune cells. Recent data suggest that production of intestinal antimicrobial peptides and inflammatory cytokines are modulated by probiotics and commensal bacteria. This review will summarize mechanisms by which probiotics and prebiotics can affect health by modulating bacterial populations in the gut and mucosal immunity. The current understanding of the cross-talk between beneficial and commensal bacteria and the host remains limited and further research is still necessary to characterize complex interactions among probiotics/prebiotics, microbiota and gut health.

Key Words: probiotics, prebiotics, intestine

645 A review of the use of direct-fed microbials to mitigate pathogens and enhance production in cattle. T. A. McAllister*[1], K. A. Beauchemin[1], J. Baah[1], R. M. Teather[1], and K. Stanford[2], [1]*Agriculture & Agri-Food Canada Research Centre*, *Lethbridge, Alberta, Canada*, [2]*Alberta Agriculture and Rural Development*, *Lethbridge, Alberta, Canada*.

Direct-fed microbials (DFMs) or probiotics have been employed in ruminant production for over 30 years. Originally, DFMs were used primarily in young ruminants to accelerate establishment of the intestinal microflora involved in feed digestion and to promote gut health. Further advancements led to more sophisticated mixtures of DFMs that were targeted at improving fibre digestion and preventing ruminal acidosis in mature cattle. Thus, these second-generation DFMs undoubtedly contributed simultaneously to the improvements in milk yield, growth and feed efficiency that have been observed in some production studies involving DFMs, but results have been inconsistent. More recently, there has been an emphasis on the development of DFMs that exhibit activity in cattle against potentially zoonotic pathogens such as *Escherichia coli* O157:H7, *Salmonella* spp. and *Staphylococcus aureus*. Regulatory requirements have limited the microbial species within DFM products to organisms that are generally recognized as safe, such as lactic acid-producing bacteria (e.g., *Lactobacillus* and *Enterococcus* spp.), fungi (e.g., *Aspergillus oryzae*), or yeast (e.g., *Saccharomyces cerevisiae*). Development of DFMs of rumen origin has also been explored with lactate-utilizing species (e.g., *Megasphaera elsdenii*, *Selenomonas ruminantium*, *Propionibacterium* spp.) or cell wall-degrading isolates of *Butyrivibrio fibrisolvens*, but these products have not seen widespread commercial use. Our limited knowledge of gastrointestinal microbial ecology continues to present a challenge to the development of DFMs that are efficacious over a wide range of ruminant production systems. Few studies have employed molecular techniques to study in detail the interaction of DFMs with native microbial communities or the ruminant host. Advancements in the metagenomics of microbial communities and the genomics of microbial-host interactions could allow development of DFMs with the capacity to improve production and promote health in a manner analogous to that presently achieved through the use of antimicrobials.

Key Words: probiotic, lactobacilli, rumen

646 Influence of functional food on intestinal microbiota and their subsequent relationship with health. J. Escobar* and M. A. Ponder, *Virginia Polytechnic Institute and State University*, *Blacksburg*.

Food substances, containing carbohydrates, fats, protein and water provide nutrients for maintenance, production, and animal well-being. The term functional food describes foods with proven or purported health benefits beyond their nutritive functions. Because the lack of nutrient intake is deleterious to the health status of any living organism, it is then cumbersome to think about a food that is not "functional". However, the term "functional" typically refers to those foods that can be described as health promoting and disease preventative and commonly include carotenoids, fibers, fatty acids, flavonoids, minerals, phenolic acids, plant stanols/sterols, prebiotics, probiotics, phytoestrogens, soy proteins, etc. Addition of ZnO in broiler diets to provide Zn to achieve maximal growth will be considered a food, whereas pharmacological inclusion of ZnO in the diet of weaned pigs to reduce scouring can be considered a functional food. Minerals, prebiotics, probiotics, and phytoesterogens are common "functional" ingredients of animal feed. These functional dietary components may alter gut microbial populations, which undoubtedly leads to the preferential growth of certain microbes. Functional foods with intestinal effects include compounds directly interacting with the gut, like plasma proteins, and prebiotic (e.g., mannanoligosaccharides, fructooligosaccharides) and mineral (e.g., ZnO, $CuSO_4$) compounds capable of direct or indirect growth enhancement of certain microbial species. Recent findings in humans and rodents indicate that the intestinal microbial community may play a role in chronic diseases such as obesity and diabetes. Preliminary results in animal agriculture indicate significant differences in the microbial composition of pigs with different body conditions and genetic backgrounds. In general terms, reductions in pathogenic or undesirable bacterial with concomitant increases in desirable or beneficial microbial species in the intestine can result in reduced localized and systemic immune activation, and hence increasing the performance of healthier animals.

Key Words: functional food, iIntestinal microbiota, animal health

647 Influence of fermented products on health. E. Farnworth*, *Food Research and Development Centre, Agriculture and Agri-Food Canada*, *Saint Hyacinthe, QC, Canada*.

The fermentation process not only can preserve foods, but it can also cause changes to the food matrix that are beneficial to health. The challenge is to find bacteria that exert beneficial effects, and at the same time can survive in the food / beverage matrix. The list of potential health promoting probiotic bacteria grows; the number of foods into which they can be added is not as large. Cows' milk is the starting point for the most common fermented products (yogurt, Kefir, fermented milks) in Canada and the USA. World-wide, a variety of fermented foods are being consumed. With proper production, packaging, and storage, fermented products contain live bacteria when consumed. It is apparent, that for many probiotic products to exert their beneficial effects, the bacteria consumed must be alive when they reach their site of action, normally the lower gastrointestinal tract. Studies have now been published that show that consumption of yogurt is effective in protecting against, and reducing the duration of, several types of diarrhoea. There may be some cases, where the requirement for alive bacteria to be consumed may not be necessary. During the fermentation process, the responsible bacteria produce bioactives from the constituents of the food being fermented. For example, the action of bacterial proteinases and peptidases produce bioactives from cows' milk proteins. In other foods during the fermentation process, the bacteria can be carrying out metabolic processes themselves that generate bioactive compounds (such as exopolysaccharides). In both cases, it is these bioactives that are the source of beneficial effects; there is no requirement that the responsible bacteria be alive when consumed. Bioactives derived from cows' milk protein have been shown to have ACE inhibitor, antimicrobial, and antithrombotic properties. Bioactive exopolysaccharides have been shown to prevent the initiation and growth of certain cancers.

Key Words: fermented, health, probiotic