

ABSTRACTS
Thursday, July 29, 2004

SYMPOSIA AND ORAL SESSIONS

* Author Presenting Paper

Animal Health: Symposium: Integrative Aspects of Immunity, Nutrient Metabolism, and Production in Livestock

862 What are the costs of immunity? Kirk C. Klasing^{*1}, Brooke D. Humphrey¹, Alfonso J. Mireles², and Elizabeth A. Koutsos³, ¹Department of Animal Science, University of California, Davis, ²Department of Feed Research, Foster Farms, ³Department of Animal Science, California State University, San Luis Obispo.

Studies in animal nutrition often describe changes in the immune response that occur when higher levels of nutrients are added to the diet and ascribe these changes to the high needs of the immune system. Likewise, the decrease in growth and productivity that occur during an infectious challenge are normally blamed on the diversion of nutrients to support the immune response. An accounting of the costs of immunity must be accurately made for these theories and arguments to have a sound quantitative basis. Additionally, an understanding of the priority of leukocytes for nutrients is needed in order to determine susceptible populations. The costs of maintaining the immune system are related to allocating nutrients for the continued production of leukocytes, immunoglobulin, and other plasma proteins to replace those lost during normal turnover of cells and extracellular proteins. The costs of using the immune system to thwart the invasion of potential pathogens come in three primary forms. First, there are nutritional costs of mobilizing the responding cell types and fueling their effector functions. Second, there are losses in tissue function that result from damage incurred when leukocytes engage their effector mechanisms and damage tissue integrity and host cell viability (collateral damage). The primary cost of an authentic pathogen challenge is due to the systemic acute phase response, especially recruitment of the liver to aid the immune system by producing protective proteins. Third, additional costs do not appear to be related to effector functions of the immune system and include a loss of bone mass and strength, dissipation of carotenoids and increased metabolic diseases.

Key Words: Immune Response, Requirements, Maintenance

863 Interactive responses in gut immunity, and systemic and local changes in the IGF system in nursery pigs in response to *Salmonella enterica* serovar Typhimurium. B. J. Johnson^{*}, S. S. Dritz, K. A. Skjolaas-Wilson, T. E. Burkey, and J. E. Minton, Kansas State University, Manhattan.

In recent years, we've sought to understand how disparate endocrine and immune signals converge in response to *Salmonella enterica* serovar Typhimurium (ST) to impact growth and the IGF system in the nursery pig. The enteric pathogen ST interacts with gut epithelium to rapidly upregulate the chemoattractive chemokines interleukin-8 and chemokine ligand-20, and to selectively affect toll-like receptors. Activation of these components of the innate immune system appear to confine the immune response largely to the gut mucosa and mesenteric lymph nodes as evidenced by the lack of systemic elevation of proinflammatory cytokines. Despite the apparent restriction of proinflammatory signals to the gut-associated lymphoid tissue, ST provokes peripheral sequelae consistent with danger signaling, including the febrile response and activation of the adrenal axis. Also, pigs undergoing ST-induced febrile responses experience a consistent period of inappetence that is independent of changes in leptin. Additionally, this period of depressed intake is invariably accompanied by an unmistakable decline in serum IGF-I and, less consistently, with parallel reductions in circulating IGFBP-3. More recently, we have characterized changes in expression of components of the IGF system within skeletal muscle of pigs undergoing ST-associated enteric disease. Despite the characteristic decline in circulating IGF-I, relative abundance of skeletal muscle IGF-I and IGFBP-3 mRNA was unaffected by ST. However, mRNA for IGFBP-5 was reduced in skeletal muscle of ST-challenged pigs, suggesting a possible effect of the enteric disease on IGF availability. Taken together, oral challenge with ST engages elements of the mucosal innate immune system that appear to contain the spread of systemic proinflammatory cytokine signals. Even so, ST challenge is associated with parallel changes in both systemic and local IGF systems that may impact pig growth.

Key Words: IGF, Pigs, *Salmonella Enterica*

864 Protein tyrosine nitration: a membrane-organized mechanism for altered signal transduction during proinflammatory stress. T. H. Elsasser*¹, S. Kahl¹, J. L. Sartin², and C. Li¹, ¹USDA, Agricultural Research Service, Beltsville, MD, ²Auburn University, Auburn, AL.

Three constitutive isoforms of NO synthase (NOS), i.e., endothelial, neuronal, and mitochondrial (a fourth isoform being the high-output inducible form) impact physiological processes through their respective localized low-output production of NO from arginine. Their activities are regulated through specific phosphorylations and cofactor interactions. A significant feature of NO-based cellular function resides in how NO is processed in association with the prevailing redox conditions within cells. Under minor anoxic conditions where tissue pCO₂ increases, concomitant generation of NO via NOS and superoxide anion via xanthine oxidase, can lead to the condensation of these free radicals to form the highly reactive oxynitrogen anion peroxyxynitrite (ONOO⁻). A major intracellular target for ONOO⁻ is the phenolic ring of protein tyrosines where the attack results in the formation of nitrotyrosine. Nitrated proteins are identifiable by the immunohistochemical localization of nitrotyrosine in a growing number of acute and chronic diseases. We have shown that nutrition is capable of modulating the development of protein nitration during low-level proinflammatory stress. Nutrition regulates NO production rates as well as provides a sink to alter the interaction of NO with intracellular components and mops-up ONOO⁻ via scavenging capabilities of α - and γ -tocopherols. Most recently, however, we have identified membrane-based caveolae as sites of epitope-specific nitrations that appear to play a functional role in the acute modulation of signal transduction cascades where, e.g., the anabolic processes driven by the GH-IGF-1 axis need to be curtailed to facilitate alternative nutrient use paradigms for immunoresponse. Collectively, nutrient management of host response to immune challenge contributes significantly to how protein nitration reactions are processed and their study offers potential to develop intervention strategies to maintain animal health.

Key Words: Signal Transduction, Nitric Oxide, Nutrition

Extension Education: The Use of Electronic Media for Extension and Producer Education

866 Maximize your efficiency through online knowledge Bases. C. H. Wood* and A. S. Griffin, *University of Kentucky, Lexington.*

Internet technology has dramatically changed access to information. Technology does not determine change but encourages us to seek new solutions. Our clientele are seeking new solutions by accessing information in the fastest, most cost-efficient way online. A dynamic knowledge base that learns with each clients inquiry can provide such a solution. A knowledge base is a database of questions and answers. It is more than frequently asked questions (FAQ). FAQs are usually just text-based lists of questions and answers about a topic. A knowledge base is searchable, but has additional search options that search on keywords that don't appear in the question or answer. A self-learning knowledge base learns through seeding, capturing, organizing, and managing information. The knowledge information is published to a knowledge base, allowing users to search and find answers on their own through a Web interface. Users have the ability to search for answers to their questions based on the context of their queries. Users who are unable to find answers to their questions have the ability to submit questions. Based on clients past queries, answers are organized so the from the most most useful information moves to the top of the knowledge base ensuring that users find answers to their questions quicker. In the current Extension environment, specialists are asked to be more efficient. A quick way to become more efficient is to reduce the amount of time spent answering redundant or similar questions. The underlying factor is that these repeated questions are still important because clientele are still asking them. How can specialists better handle these similar questions and free up time to develop more effective programming while embracing new ways of information delivery? To address these issues, the Southern Region Equine Extension Specialists developed HorseQuest.info, a self-learning, client-driven knowledge base. It self-propagates based on user interaction and expert responses. In essence, the client populates the knowledge base with the most useful information to them.

Key Words: Extension, Online, Knowledge Base

865 Parturition-Induced Changes in Neutrophil Gene Expression: Implications for Cell Function. J. L. Burton*, S. A. Madsen, L.-C. Chang, P. S. D. Weber, K. R. Buckham, and P. M. Coussens, *Department of Animal Science, Michigan State University, East Lansing.*

Neutrophils (PMN) are the focus of many mastitis studies because of the critical role they play in immune defense against intramammary infections. However, physiological and molecular factors that induce functional changes in PMN during the mastitis-susceptible parturient period are unknown. In our recent immunogenomics studies we hypothesized that circulating PMN become targets of fluctuating parturient steroids, responding with altered expression of master genes that regulate the cells' innate immune activities. We used RNA from PMN of periparturient cows in cDNA microarray, DDRT-PCR, and other experiments to monitor the cells' gene expression and phenotypic profiles. Correlation analyses and in vitro experiments were performed to test possible contributions of cortisol, estradiol, and (or) progesterone to changes in these profiles. To date, the largest ontological cluster of affected PMN genes encode proteins involved in apoptosis regulation, with smaller clusters of affected genes also involved in cell trafficking, opsonic phagocytosis, oxidative metabolism, and less well studied tissue remodeling functions of the cells. Correlation analyses revealed cortisol as a probable factor in the profile changes observed at parturition, and this was largely confirmed in follow-up in vitro studies in which steroids were applied directly to isolated PMN. The nature of identified changes in gene expression and cell phenotype has led us to develop an untested hypothesis, that the surge in parturient cortisol acts to redirect PMN gene expression for extended longevity with heightened tissue remodeling capacity at the expense of their traditional but short lived bactericidal functions. Such a shift would be consistent with the documented role of PMN in cervical and placental remodeling that enables parturition to occur in humans, and may help account for mastitis susceptibility around calving.

Key Words: Neutrophil, Gene Expression, Apoptosis

867 The power of W³: delivering courses, training, and extension programs over the web. A. S. Griffin* and C. H. Wood, *University of Kentucky, Lexington.*

Its not if you build it they will come but the fact that they are already here. Sixty three percent of the U.S. population over the age of 18 is online. Over three-quarters of youth ages 12 to 17 use the Internet. By the fall of 2002, 63 million Americans (34%) used the Internet to conduct education-related research and seek training online. In addition, three out of four Internet users have searched for information related to a hobby or special interest. As the need for quality, non-biased material increases, so does the role of educators and the expectations of the resources they provide. Online learners benefit from being able to gain knowledge through multiple delivery formats: written material, streaming audio and video, interactive games and quizzes, asynchronous and synchronous dialogue, and simulated animations. These tools, delivered in an anyplace, anywhere, anytime, and any platform format, bring new life into the quality of material available to anyone. Many educators have not been trained to conduct courses or Extension programs at a distance. However, once engaging in providing educational materials online, they realize the freedom of time and reduction in redundancy from that of traditional methods. Teaching face-to-face, through written publications, instructional video, and video conferencing formats are all examples of instruction that can integrate seamlessly into online learning environments. The most traditional forms of online course delivery can be achieved through proprietary courseware offered at most universities. However, materials and modules can be successfully prepared through conventional Web sites. Advances in voice over Internet Protocol (IP) allow synchronous learning through standard 28.8 modem connections. Innovations in the use of wireless technology through wireless devices further expand learning potential. Consider the possibilities: for extension clientele and professionals, continuing education, credit, not-for credit, graduate training, and even collaborative teaching, to name a few.

Key Words: Extension, Web, Training