and leptin CONC. Greater pre-suckling ghrelin CONC were measured in lambs from shorter gestations, and when born to ewes with high pre-lambing leptin CONC. Lamb leptin CONC declined with increasing gestational age at birth. In conclusion, lambs exhibiting greater metabolic and endocrine maturity at birth had improved survival to 72 h after birth in a cold environment.

Key Words: neonate, survival, sheep

540 Maternal over-nutrition induces inflammatory response in large intestine of fetal sheep in late gestation. X. Yan*[1], M. Du[1], B. W. Hess[1], S. P. Ford[1], P. W. Nathanielsz[1,2], and M. J. Zhu[1], [1]*University of Wyoming*, *Laramie*, [2]*University of Texas Health Sciences Center*, *San Antonio*.

The intestinal mucosal immune system (MIS), which develops largely during the fetal period, plays a key role in defending against potentially pathogenic bacteria. It was hypothesized that maternal over-nutrition induces an inflammatory response in the fetal large intestine which may permanently alters fetal MIS development and, thus, the prevalence of bacteria in their gastrointestinal tract postnatally. Non-pregnant ewes were assigned to a control (Con, 100% of NRC recommendations, n=8) or obesogenic (OB, 150% of NRC, n=8) diet from 60 d before to 135 d after conception, when fetal large intestine was sampled for western blotting and real-time PCR analyses. mRNA expression of Toll-like receptor (TLR) 2 and TLR4 was increased ($P<0.05$) by 108 ± 23% and 53 ± 7% in OB versus Con fetuses. The mRNA level of macrophage markers, CD11b, CD14 and CD68 was also increased ($P<0.05$) by 75 ± 42%, 69 ± 17% and 204 ± 52%, respectively. The proinflammatory cytokines TNFα and IL6 were increased ($P<0.05$) by 91 ± 33% and 167 ± 29%, respectively. The expression of IL-1α and IL8 was increased ($P<0.05$) by 68 ± 16% and 97 ± 22%, respectively, while IL-Iβ tended to increase (48 ± 15%: $P = 0.06$). Monocyte/macrophage chemotactic protein-1(MCP-1) was upregulated in the OB group by 30 ± 13% ($p = 0.05$), and upregulation ($P<0.05$) of phos(p)-JNK (36 ± 13%), pIKKβ (52 ± 13%) and its downstream component p-p65 (29 ± 11%) was demonstrated in OB versus Con fetuses. In summary, maternal over-nutrition enhances expression of pro-inflammatory cytokines in the fetal large intestine, which may permanently alter MIS development. Since the MIS is responsible for the body defense against opportunistic pathogens, alteration of fetal MIS development in response to maternal over-nutrition may have long-term impacts on offspring health, and the safety of their meat products.

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Key Words: sheep, fetus, gut

541 An *in vivo* comparison of muscles formed from broiler and layer chick somites. P. E. Mozdziak*, D. Hodgson, and J. N. Petitte, *Department of Poultry Science, North Carolina State University*, *Raleigh*.

Unique avian genetic resources at NC State University were employed to test the hypothesis that the embryonic environment has a greater impact on muscle size than the genetic growth potential of muscle-precursor cells. The somites (#17-20; including a portion of the associated neural tube) that form the right *Pectoralis thoracicus* were removed from broiler chick embryos, which are genetically predisposed to form large muscles, and replaced with tissue containing the somites from transgenic, layer strain chick embryos (eGFP or *lacZ*), which are genetically pre-disposed to form small muscles. Broiler somites were also transplanted into a layer background, and broiler somites were also transplanted into a broiler background as a sham control. Subsequently, 18 day embryos were harvested and myofiber diameters were assessed for the left (background) and right (experimental) *Pectoralis thoracicus*. Myofiber cross-sectional area was significantly lower ($P< 0.05$) for layer-derived-muscle (right side; 11.2±1.0 μm^2) than the broiler-derived muscle (left side; 19.2±2.8 μm^2). However, myofiber cross-sectional area of broiler-derived muscle (right side; 8.8±1.7 μm^2) in a layer background was not significantly ($P > 0.05$) different than observed for the layer background muscle (left side; 8.3±1.1 μm^2). No significant difference was found between sides when broiler somites were cross-transplanted between broiler embryos (14.2±3.5 μm^2; 15.8±4.8 μm^2). Embryos with layer somites were transplanted into a broiler background were cultured through hatching, and chicks were grown to 8 weeks of age. Muscle weights were lower ($P < 0.05$) in the transgenic layer-derived muscle (233 g) than the broiler-derived background muscle (244 g). However, the layer-derived muscles were also larger than expected for un-manipulated layer chicken of the same age. It appears that the *in vivo* environment drives the donor cells to exceed their normal *in vivo* potential, but the donor muscles retain a lower growth potential than the higher growth potential of the host animal.

Key Words: avian, embryo, development

International Animal Agriculture: ASAS-EAAP Global Issues

542 Animal agriculture in developing countries: Population pressures, income growth, climate change, and the management of global genetic resources. D. Gollin*, *Williams College*, *Williamstown, MA*.

The UN predicts that world population will rise from 6.5 billion today to 9.1 billion in 2050, with all the increase taking place in today's less developed countries. Among the countries experiencing large absolute increases are some, such as China and India, where incomes are also rising. Taken together, rising populations and incomes will drive up demand for animal products. Projections suggest that meat demand in developing countries could grow by 2.4% annually to 2030, with milk demand rising at 2.7%. Growth in animal agriculture in the developing world will interact significantly with climate change. More animals, raised in more intensive production systems, will add to emissions of greenhouse gases. Even absent these emissions, the IPCC's projections suggest that mean temperatures will rise by about 1-1.5° C in much of developing Asia and Africa by 2050. Temperature increases will stress traditional crop and livestock systems. Production systems that involve controlling the environment are likely to flourish, taking market share from traditional systems. Thus, intensive production systems seem likely to gain at the expense of backyard production. These trends are likely to have a double effect on animal genetic resources. On the one hand, traditional phenotypes and genotypes may be displaced by the shift towards intensive management systems. On the other hand, the demand for traits associated with tolerance to biotic and abiotic stresses may increase, especially with continued advances in biotechnology. This implies an urgent need to pursue intensive collection and conservation of animal genetic resources. Market forces are unlikely to meet this challenge. On

the contrary, the "tragedy of the commons" applies to genetic resources. Many producers would like continued access to the genes of traditional breeds, but none has much incentive to bear the costs of collection and maintenance. The international community needs mechanisms to provide this global public good. Public-private partnerships hold promise; industry support for public initiatives will be essential.

Key Words: animal genetic resources, climate change, demand growth

543 Adaptation of the livestock sector to global climate change: Opportunities and options for animal genetic resources and management systems in developing countries. S. Fernandez-Rivera*, *Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias*, *Mexico City, D.F., Mexico*.

Model simulations are used to identify hot spots in developing countries where climate changes may result in new challenges to livestock production. Areas where climate changes may result in favorable situations for livestock production are also identified. The production systems practiced in those hot spots and their driving forces are described and their likely responses to temperature and rainfall variations are discussed. Variations in rainfall will have a major effect on quantity and quality of feed resources available, whereas higher temperatures will influence the prevalence of disease related factors and will have a direct effect on animals. Opportunities for livestock producers to adapt to those changes, with emphasis on animal genetic resources and specific traits are presented.

Key Words: climate change, livestock, developing countries

544 The role for animal genetic resources under global climate change conditions and rapid development of the livestock sector. I. Hoffmann*, *FAO*, *Rome, Italy*.

The livelihoods of one billion poor people are sustained by livestock. The livestock sector is the world's biggest land user and is associated with 18% of total greenhouse gas emissions. In large areas of developing countries, climate change threatens the livelihood of smallholders and pastoralists and may accelerate the erosion of animal genetic diversity. The paper will explore how animal genetic diversity is affected by climate change, and how it contributes to adapt to and mitigate climate change. Developed and developing countries differ in their adaptation capacity and the expected interactions between climate change adaptation and mitigation. Developing countries will have to apply a closer relationship between climate change adaptation and development policy. They also have weak capacity for high-tech breeding programes to increase their breeds' adaptation. Depending upon the ecosystem changes brought about by climate change and other pressures, the portfolio of breeds demanded by society will change. We assume that climate change itself, and the resulting disintegration of the components of (agricultural) ecosystems, together with human migration will increase the pressure to maintain wide access to animal genetic resources. Comprehensive policy frameworks that foster access to genetic resources as well as the development and use of appropriate technologies need to be developed. The recent adoption of the Global Plan of Action for Animal Genetic Resources provides for the first time an internationally agreed framework to promote creating these crucial conditions for the global livestock sector.

Key Words: animal genetic resources, climate change

545 The impact of global climate change, utilization of genetic resource management and livestock sector development on nutrition and health in developing countries. Y. Plante*[1] and H. Blackburn[2], [1]*Agriculture and Agri-Food Canada*, *Saskatoon, SK, Canada*, [2]*United States Department of Agriculture*, *Fort Collins, CO*.

Globally livestock employ 1.3 billion people and create livelihoods for one billion of the world's poor. In addition they provide one third of humanity's protein intake and therefore are a remedy for undernourishment. Livestock's growing role in developing country food security is evidenced by an increase (from 1960 to 2003) of milk (70%) and meat (190%) consumption when compared to an 18% increase in cereal consumption during the same time period. The full ramifications of global climate change, its interaction with animal genetic resources for food and agriculture and the ultimate ability of local production systems to provide animal products and to sustain food security or income to developing country smallholder farmers and landless people is unclear. Predicted climate changes will affect soil erosion and fertility, crop, forage and livestock management in terms of decision making regarding water resources, seeding and harvesting different varieties, pest and disease control, and locally adapted livestock species and breeds, especially in tropical and sub-tropical regions. Clearly mitigating actions are needed to buffer such events and to insure that livestock's contribution to health, nutrition and economic growth continues. It has been suggested that livestock producers will make the necessary adjustments, for example by abandoning traditional cattle breeding and adopting small ruminant husbandry practices. However, a number of policy and technological changes will have to occur for a systematic transition to new animal production systems so that livestock smallholders and pastoralists may be protected against greater levels of food insecurity. How these producers can buffer themselves from such changes is important and exploration into this subject is crucially needed so that governments and multilateral agencies can work toward potential solutions.

Key Words: climate change, animal genetic resources, food security

Lactation Biology: Lactation Biology 2

546 Prolactin, insulin and cortisone regulate expression of GLUT8 gene in bovine mammary explants. K. Zhao*, H. Y. Liu, and J. X. Liu, *Institute of Dairy Science, Ministry of Education Key Laboratory of Molecular Animal Nutrition, Zhejiang University*, *Hangzhou, P.R. China*.

Lactogenic hormones are known to regulate milk synthesis and secretion in lactating dairy cows, but knowledge about their possible effects on glucose transporters in mammary gland at tissue level remains controversial. GLUT8 is a newly identified member of the facilitative glucose transporter family, and may play an important role in glucose uptake in the lactating mammary gland. This study was aimed at investigating effects of the three primary lactogenic hormones, prolactin, insulin, and cortisone, on expression of GLUT8 mRNA in cultured bovine mammary tissue taken from the mid-lactating dairy cows. The mRNA expression was determined by SYBR green method of quantitative reverse tran-