among individual broilers. It was proposed that this individual variability may reflect immunological differences acquired during previous respiratory challenges that might have subsequently altered the endotoxin-initiated immune cascade. In the current study we test the hypothesis that, when compared with broilers reared in clean stainless steel cages, broilers reared on floor litter should experience a greater respiratory challenge and therefore may consistently exhibit a more enhanced pulmonary hypertensive response to intravenous endotoxin. Birds in the Cage group were grown in stainless steel cages at a low density (72 birds/8 m² chamber), and fecal and dander materials were removed daily. Birds in the Floor group were reared on wood-shavings litter at a higher density (110 birds/8 m² chamber). Pulmonary and systemic mean arterial pressures and blood-gas values were evaluated prior to and following the intravenous administration of 1 mg Salmonella typhimurium endotoxin. Broilers in the Floor and Cage groups exhibited pulmonary hypertensive responses to endotoxin that were very similar in terms of time of onset, duration, magnitude, as well as variability in the response among individuals. Systemic hypotension also developed similarly in both groups following endotoxin injection. The partial pressure of CO₂ and the HCO₃⁻ concentration in arterial blood were higher (P < 0.05) in the Floor group than in the Cage group prior to and subsequent to the endotoxin injection. We conclude that broilers, reared on the floor inhaled litter dust and noxious fumes, which impaired pulmonary gas exchange and increased the arterial partial pressure of CO₂ when compared with broilers reared in clean stainless steel cages. Nevertheless, the pulmonary hypertensive response to endotoxin did not differ when broilers reared on the floor or in cages were compared.

**Key Words:** Endotoxin, Pulmonary hypertension in broiler, Blood-gas values

### 128 DNA microarray analysis of liver genes during the metabolic jump from chorioallantoic to pulmonary respiration.

K. W. Koelkebeck* X. Wang W. Carre L. Rejo, and L. A. Cogburn, University of Delaware, Newark, DE.

DNA microarrays are considered as biotechnology’s discovery platform for functional genomics and are widely used for genome-wide studies of model organisms (except birds). We have recently developed a 3,456 element chicken liver DNA microarray containing about 3,100 unique (non-redundant) cDNA clones and a large number of quality control spots printed on 8 x 12 cm nylon membranes. To validate this powerful new molecular tool, we have examined global expression of hepatic genes during the peri-hatch period— or the metabolic jump from chorioallantoic to pulmonary respiration. We collected the liver from four embryos at 16, 18 and 20 Days and four chicks at 1, 3 and 9 days post-hatching. Total RNA was isolated from each liver sample and used for reverse transcription of liver mRNAs in the presence of 33P- dCTP. These 33P-labeled cDNA probes prepared from each liver sample were hybridized to a DNA microarray. After stringent washing, the membranes were exposed to a PhosphorImager screen and images analyzed by Pathways4 software (ResGen). Our major comparison of hepatic genes was the differential expression between embryos and hatching chicks. This abrupt metabolic event from ectothermic embryos to free-living endothermic chicks increases (2-2 fold) the expression of several interesting genes involved in fat metabolism [insulin receptor substrate 1, fatty acid synthase, liver fatty acid binding protein, ATP-citrate lyase, glycogen phosphorylase, Spot 14 (thyroid hormone-inducible hepatic protein), TGF-β1 and chomogranin] and several unknown genes. A number of other important genes (and unknown genes) are down regulated after hatching [e.g., 7-transferrase, aldolase-a and -b, conalbumin, enolase-a, STAT 1 and pyruvate dehydrogenase kinase-4]. For a complete list of differentially expressed genes in embryos and hatching chicks, please see our website [http://udgenome.ags.udel.edu/ cogburn/]. Thus, genome-wide gene expression scans will enable us to functionally map the genetic pathways that control metabolism, growth, development, reproduction, and environmental adaptation of chickens.

**Key Words:** Gene Expression Profiling, DNA Microarrays, Functional Genomics, Peri-hatch Metabolism

### 129 Functional and morphological development of the chick small intestine during incubation.

Elad Tako* Zehava Uni, and David Sklan1, 1Faculty of Agriculture, Hebrew University of Jerusalem, Rehovot, Israel.

This report describes the morphological and functional development of the embryonic small intestine of the broiler. Histological observations and chicken cDNA probes specific for sucrase-isomaltase, aminopeptidase, sodium-glucose transporter (SGLT-1) and Na+K+ATPase genes were used to follow the morphological changes and activity and RNA expression of these brush border enzymes and transporters. From day 15 of incubation the small intestine entered an accelerated phase of development. Small intestine weight was elevated in relation to embryo body weight increasing from less than 1% on day 17 of incubation to 4% at hatch. The height of small intestinal villi increased although development was not uniform for all villi and villi in three different stages of development were observed simultaneously. Low sucrase-isomaltase activity was detected during 15-17 days of incubation, however major increases in activity were detected on day 19 of incubation and a further 2 fold increase on the day of hatch. A similar pattern of activity was detected for the brush border aminopeptidase and for the Na+K+ATPase and the SGLT-1 transporter. A dramatic increase in expression of all genes examined was observed on day 19 of incubation. These results indicate that the embryonic digestive system undergoes dramatic changes during the last days of incubation and exhibit ability to digest and absorb 2-3 d before hatching.

**Key Words:** Chick, Brush border, Gene expression, Embryo

### Environment & Management Layers

**130 Evaluation of aluminum sulfate manure treatment application on ammonia generation rate and manure properties of laying hen manure.** K.W. Koelkebeck* and P.C. Harrison, University of Illinois, Urbana, IL.

An experiment was conducted using 81 commercial laying hens to determine if application of an aluminum sulfate (Standard liquid [48% Al₂(SO₄)₃·14 H₂O]) based commercial product (AL₃ Clear®) to their manure would influence ammonia generation rate proportional to the concentration at which it was applied. In order to evaluate the relationship between concentration of AL₃ Clear® and ammonia generation rate the following daily manure treatments were used: 1) Water - maneure sprayed daily with 40 ml of deionized-distilled water; 2) Reduced - manure sprayed daily with 40 ml of aluminum sulfate Standard liquid diluted 1:3 by volume with deionized-distilled water; and 3) Standard - manure sprayed daily with 40 ml of aluminum sulfate Standard liquid. Regardless of AL₃ Clear® concentration all treatments were sprayed daily with 40 ml of deionized-distilled water or AL₃ Clear® aqueous solution, over approximately 1.6 ft² of manure collection area. The treatments were applied for two weeks and ammonia generation rate was measured in specialized emissions calorneters on Day 1, 7, and 14, and manure properties were analyzed from Day 7 and 14 collections, following the start of the experiment. The results indicated that daily spraying of Reduced and Standard AL₃ Clear® treatments reduced ammonia generation rate. The percent reduction in ammonia generation (mg NH₃/b/kg manure) averaged 89 and 97% for the Reduced and Standard treatments throughout the entire experiment, respectively. There was a noticeable difference in visual appearance of the Standard treated manure when compared to the Water and Reduced treatments. The Standard treatment appeared lighter in color and was less porous on the surface. Nitrogen and phosphorus levels obtained from manure samples indicated that these factors were affected by treatments and age. The only strong linear correlation (R² = 0.95) between the variables was between pH and soluble P₂O₅. All other linear correlations had R² values that were less than 0.40. These data indicate that the embryonic digestive system undergoes dramatic changes during the last days of incubation and exhibit ability to digest and absorb 2-3 d before hatching.

**Key Words:** Ammonia generation rate, Manure treatment application, Ammonia inhibitor
131 Alternatives to antibiotics. Bacteriocins, antimicrobial peptides and bacteriophages. R. D. Joeger*, University of Delaware, Newark, DE.

Bacteriocins, antimicrobial peptides and bacteriophage have attracted attention as potential substitutes for, or as additions to, currently used antimicrobial compounds. This presentation will review research on the potential applications of these alternative agents in the prevention and control of infections and foodborne diseases. Bacteriocins are proteinaceous compounds of bacterial origin that are lethal to bacteria other than the producing strain. It is assumed that some of the bacteria in the intestinal tract produce bacteriocins as a means to achieve a competitive advantage, and bacteriocin-producing bacteria might be a desirable part of competitive exclusion preparations. Purified or partially purified bacteriocins could be used as preservatives or for the reduction or elimination of certain pathogens. Currently only nisin, produced by certain strains of Lactobacillus lactis subsp. lactis, has regulatory approval for use in certain foods, and its use for poultry products has been studied extensively. Exploration of the application of antimicrobial peptides from sources other than bacteria to poultry has not yet commenced to a significant extent. Evidence for the ability of chickens to produce such antimicrobial peptides has been provided, and it is likely that these peptides play an important role in the defense against various pathogens. Bacteriophage have received renewed attention as possible agents against infecting bacteria. Evidence from a number of trials indicates that phage therapy can be effective under certain circumstances. Numerous obstacles for the use of phage as antimicrobials for poultry or poultry products remain. Chiefly among them are the narrow host range of many phage, the issue of phage resistance and the possibility of phage-mediated transfer of genetic material to bacterial hosts. Regulatory issues and the high cost of producing such alternative antimicrobial agents are also factors that might prevent application of these agents in the near future.

Key Words: Bacteriocin, Peptide, Bacteriophage

132 Specificity and degree of antimicrobial resistance identified in salmonellae isolated during turkey processing. K.D. Knape1, K.M. Bischoff2, J.A. Byrd3, and D.J. Caldwell4. 1Texas A&M University, 2USDA-ARS-SPARC, Food & Food Safety Research Unit, College Station, TX.

The present investigation was initiated to determine the specificity and degree of antibiotic resistance that exists in isolates of Salmonella that were recovered from four commercial turkey processing facilities. Isolates were recovered by performing whole carcass rinses of processed turkey carcasses at four immersion-chill sampling sites within each processing facility. Salmonella isolates (422) were screened for susceptibility to 13 antimicrobials and the rates of resistance (% resistant of total isolates tested) were as follows: cefotiofur(4.3%), tetracycline(68.7%), ampicillin(15.3%), enrofloxacin(0%), sarafloxacin(0%), kanamycin(5.2%), streptomycin(56.2%), gentamicin(25.8%), apramycin(0%), trimethoprim/sulfamethoxazole(0%), streptafenodoxyne(0.2%), sulfadimethoxine-etrometoprim, and sulfaquinoxaline(92.6%). Noted resistance was observed in Salmonella isolates from individual plants to tetracycline, streptomycin, gentamicin, ampicillin, and the sulfa-based antibiotics. Importantly, resistance to the two fluoroquinolones that were approved for use in the poultry industry (enrofloxacin or sarafloxacin) was not observed. Further investigations will continue to look at turkey processing facilities to identify antimicrobial susceptibility. The data from the present study will help poultry veterinarians monitor antimicrobials for therapeutic treatment of bacterial diseases and associated potential resistance on bacterial food-borne pathogens.

Key Words: Salmonella, Antibiotic resistance, Fluoroquinolone, Sulfabased antibiotics

133 Examination of an experimental chloride product on Clostridium perfringens in a mixed gut culture. J.L. McGuire*, J.A. Byrd1, A.P. McIlroy2, R.C. Anderson3, K.D. Knape4, R.W. Moore5, L.F. Kubena6, and D.J. Nisbet7. 1Texas A&M University, 2USDA-ARS-SPARC, Food and Feed Safety Research Unit, College Station, TX, 3Virginia Tech University.

Clostridium perfringens (Cp) the etiologic agent of necrotic enteritis is an economically important pathogen of the poultry industry, causing significant morbidity and mortality in commercial flocks worldwide. As pressure mounts on the use of antibiotics in the agriculture industry, it is important to develop new strategies to combat this costly enteric pathogen. Previous reports have shown that some facultative bacteria utilize the nitrate reductase enzymatic pathway to reduce chloride to a toxic nitrite ion. Unlike most anaerobes, Cp possesses a respiratory nitrate reductase pathway, thus this anaerobe may be susceptible to an experimental chloride product (EPC). In the present investigation, an in vitro assay was developed to determine the effects ECP on Cp. Briefly, a mixed gut culture was obtained from SCWL laying hens and diluted (1:1) with thioglycollate enrichment medium. The suspension was divided into six 10 ml aliquots comprising of the following treatment groups: negative control, ECP with a 5 mM chloride ion equivalent, and ECP with a 10 mM chloride ion equivalent (n=2/group). The effects of ECP were evaluated in vitro over several time interval; 0 h, 1 h, and 3 h. The initial Cp measurement showed that there was a log value of 5.57. At the 1 h time interval there was no difference between the control (6.05 Log 10), 5 mM ECP (5.43 Log 10), and 10 mM ECP (5.50 Log 10) treatment groups. There was also a significant reduction at the 3h time point between the groups, 5 mM ECP (3.88 Log 10), and 10 mM ECP (3.29 Log 10), and control (5.51 Log 10). In the present investigation the use of ECP reduced the number of recoverable Cp at 3h time period. Further research is needed in order to determine the effects of chloride products in an in vivo model.

Key Words: Clostridium perfringens, Chicken, Chlorate

134 Performance of commercial egg laying hens between 32 and 60 wk of age after inoculation with S6-strain of Mycoplasma gallisepticum at 10, 22, or 45 wk of age. E.Y. Basenko1, E.D. Peebles2, S.L. Branton3, P.G. Gerard1, M.R. Burnham4, and S.K. Whitmarsh1. 1Mississippi State University, Mississippi State, MS, 2USDA-ARS, SCIFR, Mississippi State, MS.

Effects of inoculation with S6-strain of Mycoplasma gallisepticum (S6MG) at 10, 22, or 45 wk of age on layer performance between 32 and 60 wk were investigated. A total of 160 Hy-Line W36 strain hens were housed in a facility containing 16 isolation units with 10 birds per unit. There were 4 replicate units within each treatment group that consisted of birds that received inoculations at either 10, 22, or 45 wk of age or those that received sham inoculation (controls) at 10 wk of age. Main effects due to hen age were found for egg production, egg weight, and eggshell breaking strength. Egg production decreased with age. Percent eggshell weight was not influenced by age or treatment. Birds inoculated with S6MG at 22 wk of age were heavier than controls and those inoculated with S6MG at 10 wk of age. Egg weight was higher for birds inoculated with S6MG at 10, 22, or 45 wk of age compared to controls. Eggshell breaking strength between 33 and 45 wk was frequently higher in the 10 and 22 wk inoculation treatment groups compared to controls. Inoculation of layer chickens with S6MG at 10 or 22 wk of age led to increased egg weight and eggshell strength.

Key Words: Body weight, Egg production, Egg weight, Inoculation, Mycoplasma gallisepticum

135 Effects of negative ionization of the feed, water and environment on hen performance and egg quality. A. L. Bell1, K. Niidome2, and P. H. Patterson3. 1Penn State University, University Park, PA, 2JEM Co. LTD, Yamaga-city, Japan.

The use of negative ionization is an innovative approach to improving poultry health and production, improving water quality, reducing microbial contamination, and decreasing odor in poultry houses. Previous studies have focused on bacterial load reduction within a flock and have shown evidence that negative air ionization can be an effective means of lessening the risk of airborne transmission of Salmonella enteritidis. The focus of this study was to compare the hen performance and egg quality of birds receiving a combined ionization of the environment (51A, 120v), feed (49A, 123v) and water (45A, 116v) with birds provided a control environment, feed, and water. Two rooms with ionization equipment and two control rooms each with 120 Leghorn hens in cages were used for the study. The birds were at 18 wk of age at the time of the first treatment (JEM between treatments). During four, 4-wk periods egg production ranged from 23 to 83.2% in the ionized rooms and 20.4 to 81.7% in the control rooms. There were no significant differences in egg production in any of the four periods. Feed consumption averaged 80 and 79.4 g/bird/d for the ionized and control hens, respectively during 16 weeks of the study, and a significant treatment differences was observed only once during this period. Egg quality parameters were similar between the treatments for...
key Words: Ionization, Environment, Feed, Water, Hens and eggs

136 Influences of supplemental dietary poultry fat and F-strain *Mycoplasma gallisepticum* infection on the early performance of commercial egg laying hens. E. David Peebles1, M. R. Burnham1, S. L. Branton2, and P. D. Gerard, 1Mississippi State University, 2USDA, ARS, South Central Poultry Research Laboratory.

The influences of 1.5% supplemental dietary poultry fat (PF) and F-strain *Mycoplasma gallisepticum* (FMG) infection on the early performance of commercial egg laying hens was determined. Birds were sham- or FMG-inoculated at 12 wk, and experimental diets were initiated at 20 wk of age. Body weight at 12, 20, and 24 wk, total daily egg mass, feed consumption, and feed conversion at 20 and 24 wk, weekly egg weight between 19 and 26 wk, weekly egg production (EP) between 18 and 26 wk, and weekly mortality between 12 and 26 wk of age were determined. Inoculation of FMG had no effect on bird mortality, BW, egg weight, total daily egg mass, or feed conversion. However, FMG reduced EP at 18 and 19 wk of age. Between 20 and 26 wk, FMG reduced EP in birds fed control diets, whereas PF eliminated differences in EP between sham- and FMG-inoculated birds. Furthermore, at Weeks 20 and 24, birds consumed less feed when fed PF supplemented diets than when fed control diets if they were sham-inoculated, but the difference in feed consumption between diets was ameliorated if birds were previously inoculated with FMG. These data demonstrate that the effects of a 12-wk inoculation of FMG on PF EP and feed conversion is eliminated if fed PF in commercial egg laying chickens can be modified by 1.5% supplemental dietary PF. More specifically, PF may alleviate reductions in early EP due to FMG.

Key Words: Commercial layers, *Mycoplasma gallisepticum*, Poultry fat, Egg production, FMG

137 Sexual maturation in two strains of egg-type hens as influenced by lighting program and vitamin D source. F. E. Robinson1, R. A. Renema1, D. R. Korver1, and M. J. Zuidhof2, 1University of Alberta, 2Alberta Agriculture, Food and Rural Development.

Selection for total egg output has resulted in earlier maturing hens. Decreasing photoperiod late in rearing may hold birds out of lay, allowing time to gain body weight (BW), to generate bone calcium stores, and to improve persistency of lay. Vitamin D3 (cholecalciferol) or HY-D (25-OH cholecalciferol) may affect pullet BW gain and bone density at sexual maturity (SM). This project examined how SM and carcass traits were influenced by strain, photoperiod and vitamin D source. Hy-Line-W-36 and W-98 chicks (500 per strain) were reared at 15L:9D for wk 0-6, and 10L:14D after 6 wk. The rearing diet contained vitamin D3. At 12 wk of age, 128 pullets per strain were housed in cages in 8 rooms. The experimental design was a 2*2*4 factorial with two strains, two vitamin D sources and four lighting programs. Conventional vitamin D and HY-D were used from 12 wk of age. The four lighting programs varied in age at P-Stim (17 wk versus 19 wk) and photophase length (constant or decreasing). The programs were: 1. C17: Constant 10L:14D (6-17 wk) #17 wk photostimulation (PS) (12L-12D and 1 h/wk to 16L-8D); 2. D17: Decreasing to 6L-18D (by 16 wk) # 17 wk PS (12L-12D and 1 h/wk to 16L-8D); 3. C19: Constant 10L:14D (6-19 wk) #19 wk PS (12L-12D and 1 h/wk to 16L-8D); and 4. D19: Decreasing to 6L-18D (by 18 wk) # 19 wk PS (12L-12D and 1 h/wk to 16L-8D). At photostimulation (17 and 19 wk) and at SM, 64 birds per strain were killed for examination of carcass and reproductive morphology. At photostimulation the W98 birds were heavier (1308 g) than the W-98 birds (1219 g) and had heavier ovaries (W98: 7.70 g; W-36: 0.79 g). The W98 birds also matured earlier (W98: 140.1 d; W-36: 148.4 d) and reached sexual maturity with heavier ovaries (W98: 38.8 g; W-36: 34.5 g) with more large yellow follicles (LYF) (W98: 8.69 g; W-36: 6.16 g) with more LYF present in a multiple hierarchy (W98: 50.8%; W-36: 32.1%). Vitamin D source had no affect on age at SM or any carcass trait. The birds that were photostimulated at 17 wk came into lay sooner than those at 19 wk (C17: 140.4 d; D17: 139.9 d; C19: 148.5 d; D19: 148.1 d). The decreasing photoperiods did not delay SM. Lightening program did not affect ovary weight or number of LYF, however, the D19 hens had fewer large follicles in a multiple arrangement.

Key Words: Egg-type hens, Sexual maturation, Ovary morphology, Vitamin D, Photostimulation

138 The effect on certain production parameters created by changing the lay cycle from the daytime period to nighttime. P. L. Ruszler*, C. F. Honaker, and C. L. Novak, Virginia Tech, Blacksburg, VA, USA.

The 16 hour lighted period for one-half of two strains of Leghorns (B & C) caged 3 and 4 hens per cage at a density of 464 and 348 cm sq was shifted from the daytime period (DP) (4 a.m. - 8 p.m.) to the nighttime period (NP) (8 p.m. - 12 noon). The light pattern in 2 of 4 rooms with total light control containing 96 cages each (30.48 x 45.72 cm) housing 336 hens, 32 weeks old, was advanced 1 hour per day for 8 days from 4 a.m. - 8 p.m. - 12 noon. The purpose of this study, superimposed on another husbandry trial underway, was to confirm the results of 2 previous trials where the lighted period during the night was compared to one during daytime and involving different strains of Leghorns. Except for timing of the lighted period, standard commercial husbandry practices for the two strains were followed using 10-20 lumens of light. The range of ambient seasonal temperatures during the 28 weeks of this trial were milder than the two previous studies (< 32 C and > 4 C) and of much shorter duration which helped reduce the stress effects of temperature. The 2 strains also had superior HD production performance than the earlier strains (> 80% at 64 weeks). This resulted in no significant differences in egg production, mortality, feed intake, body weight gain or feed consumed. However, the numerical trend was the same as the previous trials except egg production where the NP hens produced 1 less egg per hen house due to lighted mortality. The NP hens ate 419 g more feed and gained 37 g body weight in this trial which was also true in earlier trials. These are positive factors showing that moving the lighted period into the nighttime hours may improve performance in hens with lower rates of production. This may be affected by the milder temperatures and less temperature fluctuation at night which can stimulate feed intake.

Key Words: Lighting, Temperature, Egg production

139 Light parameters and hen performance of commercial Leghorns illuminated with red and white fluorescent lamps. P. H. Patterson1, M. J. Darre2, 1Penn State University, University Park, PA, 2University of Connecticut, Storrs, CT.

Light is important to facilitate sight, initiate hormone release and stimulate reproduction in birds. Research has shown that wavelengths of light in the red spectrum accelerate maturity, increase egg production, and reduce nervousness and cannibalism in commercial poultry. A study to describe the parameters of red and white fluorescent lamps and their impact on the production parameters of two commercial Leghorn hybrids was initiated at 18 wk of age. Hyline-W-36 and Babcock B-300 pullets (360) where housed in 4 environmental rooms with 45 birds (9 replicates) of each strain per room. Two rooms contained 2, 7w white fluorescent lamps per room and another two identical rooms contained 2, 7w red fluorescent lamps providing a 16:8 hr light:dark cycle. Body weight at housing was not significantly different between the red and white light treatment rooms. Egg production percentage for the first three 4-week periods was not influenced by lighting treatment. However, there was a significant treatment x strain interaction in period one: red-B300, 51.9%; white-B300, 44.1%; white-W-36, 40.4%; and red-W-36, 36.4%. In period 2 there was a significant strain effect: W-36, 90.6%; and B300, 87.3%. There was also a significant strain effect on feed consumption during period one: W-36, 59.5 g/hen/d and 2: 101.8 vs 86.2 g/hen/d for the B300 vs W-36, respectively. Mortality was not influenced by the treatments and was the same for both strains and light colors at 0.55%. A spectroradiometer was used to compare the red phosphor 7w CF lamps to the standard white tri-phosphor lamps. Results indicate that only wave-lengths between 590 and 725nm are emitted from the red lamps. The peak emissions in the red portion of the spectrum of both lamps occur at about 620 to 630nm and the red lamps produce 69.71% less visible

Key Words: Lighting, Temperature, Egg production
Impact of alternative molt programs on weight loss and behavior of laying hens. K. E. Anderson*1, L. R. Minear2, and D. Joyce3. North Carolina State University, Raleigh, NC, 1Southern States Cooperative, Richmond, VA, 2North Carolina Department of Agriculture and Consumer Services, Salisbury, NC.

Animal rights groups have targeted the molting initiator of fasting laying hens, which they deem as being cruel with legislative pressure. This study examined three alternative molting programs; Non-Fasted Molt (NF); 4 d Fast Feed Restricted (SF); 13 d Fast Resting Feed (FR) in comparison to a non-molted (NM) control. Thirteen strains of commercial layers were housed in a high-rise laying house (quad-deck cage system), and a flush-pit laying house (tri- and quad-deck cage systems). This represented 468 replicates with either 32 or 28 hens per replicate for a total of 13,070 hens. Housing densities were either 310 cm² or 413 cm². The NM hens were housed in one cage row of each house (72 replicates/house) so the light program could be handled independently from the remainder of the flock. The NF, SF, and FR treatments were randomly assigned to replicates such that all strains and densities were equally represented. The molt was initiated at 66 and ended at 70 wk of age. Body weights (BW), feed consumption and production parameters were monitored throughout the molt period. The NM hens had the highest production during the molt period. Surprisingly the NM hens lost 4% of their BW as compared to NF, SF, and FR of 26, 26, and 31%, respectively. Behavior profiles were also established for 4 diverse white egg strains at a 413 cm². Each strain and molt treatment combination were watched using a modified scanning technique representing 24 replicates. Observations were made at lights on, mid-day, and just prior to lights off on two consecutive d pre-molt, onset of fast, and post-fast. The molt programs used affected behavioral traits such as preening and pecking inedible objects. Aggression frequencies were similar during pre-molt and the fast at 0.22 and 0.33% of total acts as compared to 0.62% of total acts post-fast. The lowest frequency of aggression of total acts was associated with the FR (0.18%) as compared to NF at (0.70%). The FR molting program resulted in the lowest levels of aggression compared to the other programs, and resulted in behavior patterns that were more consistent with natural molts, i.e. with increased preening and feather pecking as previously observed during feather replacement.

Key Words: Fluorescent lamp, Red, White, Hen, Egg

Effects of Food Form, Hay Cubes and Novel Foods on Cannibalism in Laying Hens. R. C. Newberry*4, S. Cloutier, and C. M. Ulibarri, Washington State University, Ctr for the Study of Animal Well-being, Pullman, WA.

Cannibalism, the consumption of tissues of conspecifics, is a serious economic and welfare problem in laying hens, resulting in injury and death of victims. We investigated the effects of stocking density and group size, imposed from 14 to 23 weeks of age, on the incidence of cannibalism in White Leghorn hens with intact beaks. We predicted that higher group size and higher stocking density would increase the incidence of cannibalism. Birds were randomly assigned to 32 treatment groups, with 8 replicate groups per treatment combination, and housed in floor-cages with litter and a low perch. Each group contained 4 or 8 birds, at a density of either 1035 or 518 cm²/bird. Feed and water were available ad libitum. Birds were monitored frequently and any bird found with a bleeding wound was immediately removed from the group. Birds with wounds to any body part other than the head were considered to have been cannibalized. Rank data on the proportion of birds placed that were cannibalized over the 23-week experiment were analyzed by analysis of variance. A high level of cannibalism occurred in groups provided feed in pelleted form (mean ± SEM, 0.48 ± 0.08) whereas no cannibalism occurred in groups provided feed in ground form (P<0.001). Hay cubes and food novelty had no effect on total cannibalism over 23 weeks. The results suggest that hens of strains with a propensity for cannibalistic behavior should not be fed diets in pelleted form, especially when maintained with intact beaks.

Key Words: Reduced claws, Beak trimming, Densities, Egg production, Mortality