

in % for N, P2O₅, and K₂O (with standard deviations in parenthesis) for the various categories of poultry litters were:

Fresh Broiler Litter (2,903 samples): 3.15(0.60), 2.77(0.81), 2.33(0.62)
 Stockpiled Broiler Litter (262 samples): 2.78(0.86), 2.84(0.94), 2.29(0.69)
 Composted Broiler Litter (62 samples): 2.80(0.98), 3.00(1.00), 2.30(0.83)
 Fresh Layer Litter (209 samples): 2.26(0.83), 3.16(1.34), 2.05(0.81)
 Broiler Breeder Litter (325 samples): 2.12(0.79), 3.14(1.17), 1.93(0.63)

As indicated by the standard deviations, litter composition can be quite variable. One possible reason for the variability might be that the samples taken by farmers do not represent the true average nutrient composition of litter within houses because of spatial variability of nutrient

concentrations. In order to characterize this spatial variability, a broiler house was sampled at 30 uniformly spaced locations, and each sample analyzed for N and P concentrations. Both N and P concentrations varied nearly twofold. Results indicate that care must be taken in sampling poultry houses, by sub-sampling from areas such as feeders and waterers in proportion to their corresponding areas within a house. With the increased awareness of potential environmental impacts of land application of manures, poultry producers can more effectively utilize poultry litter within a NMP through improved sampling procedures.

Key Words: Poultry, Nutrient, Litter

Extension and Instruction

254 A poultry industry manager survey used to characterize employable skills for undergraduate students. K. M. Downs* and J. E. Mehlhorn, *Middle Tennessee State University*.

A 27-question survey instrument was developed to assess skills important to poultry managers in achieving success in the poultry industry. Twenty questions focused on evaluating subject matter competencies and employable skills. Seven questions evaluated the importance of specific recruitment efforts. A 1-5 Likert scale (1=unimportant, 5=critically important) was used for response quantification. The survey instrument was tested by 15 outside observers. Managers in all phases of the broiler and table egg industry (i.e., live production, processing, hatchery, feed mill, human resources, marketing, and distribution) were targeted. Surveys (one front page, blue paper) were mailed with an explicative cover letter, self-addressed stamped envelope, and appreciation gift (MTSU decal). At present, response rate has been low (56.2%). A majority (57%) of managers classified their current position as either live production or processing. Managers completing the survey (n=9) indicated teamwork skills (4.89) and integrity (4.89) as the most important employable skills, while originality (3.78) was considered the least important. Oral communication abilities were considered more important than written skills (4.33 vs. 4.00), and undergraduate major was moderately important in career success (3.00). Knowledge of business (3.89) and foreign language (2.67) were evaluated, respectfully, as the most and least important subject matter competencies. Likewise, departmental career fairs were considered the most important means of recruitment (3.89), while web-based job sites were considered only minimally important (2.75). In an effort to substantiate database validity, survey administration is ongoing. However, according to the current results, efforts to foster team-building skills, problem-solving abilities, and business acumen in

undergraduate students may enhance poultry career success. Moreover, industry-academia interface remains vitally important for student job placement.

Key Words: Poultry managers, Job placement, Undergraduate education

255 An undergraduate laboratory course on animal cell culture techniques. P. E. Mozdziak*, *North Carolina State University, Raleigh NC*.

A new laboratory course emphasizing practical training in animal cell culture techniques has recently been developed at North Carolina State University. The new course is an advanced elective for the newly developed undergraduate minor in Biotechnology, which was first instituted in the fall of 2001. The course is also an elective for students in the Department of Poultry Science. The goal of the Animal Cell Culture Techniques course is for students to acquire the necessary practical skills for the isolation of animals cells for in vitro studies, maintenance of animal cells in vitro, manipulation of animal cells in vitro, and application of molecular techniques to in vitro situations. Avian cells are used as the model organism for most laboratory exercises. The course was first taught to a total of 6 graduate students in the summer session of 2001. It was successfully taught to a total of 9 undergraduate and graduate students in the spring of 2002, and there are currently 19 students registered for the spring of 2003 semester. Overall, student demand is greater than the facilities and faculty resources available to teach the course. Training in animal cell culture techniques is an essential opportunity for students studying Poultry Science and related disciplines.

Key Words: Tissue culture, Undergraduate education, Biotechnology

Genetics

256 Functional analysis of Salmonella genome for virulence genes using transposon sequence tag profiles. M. M. Cox¹, R. L. Ziprin², L. F. Kubena², D. J. Nisbet², S. C. Ricke³, and Y. M. Kwon*¹, ¹*University of Arkansas, Fayetteville, AR*, ²*USDA-ARS, College Station, TX*, ³*Texas A&M University, College Station, TX*.

An increasing number of bacterial genomes have been completely sequenced. However, the biological functions of the sequences are largely unknown for the bacteria mainly due to the lack of a comprehensive method for functional screening of bacterial genome. We devised a quantitative method for functional analysis of bacterial genomes in genome-wide scale using transposon mutagenesis and sequence tags that are defined by their positions in the transposon-flanking sequences. We demonstrated that the identity and frequency of the sequence tags provide information on the level of each mutant in the pool. The results suggest that comparing the sequence tag profiles of the mutant pools before and after selection could allow identification of transposon mutants with competitive disadvantages. We applied this method to identify the Tn5 mutants of *Salmonella enteritidis* that are attenuated during infection in 5-day-old chicks. This method is a powerful approach for categorizing gene function that should be applicable to a variety of microorganisms.

Key Words: Bacterial genomes, Transposon, *Salmonella enteritidis*, Virulence genes, Chicks

257 Relationship between PGC concentration and morphological parameters in early chick embryos. C. Tomita, K. Nomura, and A. Tajima*, *Institute of Agriculture and Forestry, University of Tsukuba*.

Stage 14 (Hamburger & Hamilton, 1951) chick embryos have been used to collect circulating primordial germ cells (PGCs) for producing germline chimeras. However, the recovery rate of circulating PGCs from the embryo varies considerably among replicates. The present study was conducted to elucidate the relationship between the concentration of circulating PGCs and morphological parameters in the stage 14 chick embryos. Three roosters and 12 hens were used in the present study. Each hen was artificially inseminated weekly with semen collected from same rooster. Collected eggs were incubated for 57.5-69.5 hours to obtain stage 14 embryos. Blood was collected from embryos using a fine glass pipette and blood cell (BC) as well as primordial germ cell (PGC) concentration was determined. After blood collection, embryo proper and vascular system surrounding embryo was removed altogether and the digital image was recorded. The morphological analysis of the embryo was conducted using the digital image. The total number of embryo samples used in the present study was 50. Average PGC and BC concentrations were $15 \pm 1.8/\mu\text{l}$ and $112,742 \pm 7,458/\mu\text{l}$, respectively. Average circumference of marginal sinus, area pellucida and embryo proper were $55.2 \pm 1.5\text{mm}$, $31.6 \pm 0.8\text{ mm}$ and $21.2 \pm 0.6\text{ mm}$, respectively. A high positive correlation was observed among three morphological parameters. However, no significant correlation was observed between PGC or BC concentration and any of the 3 morphological parameters. On the other hand, a large variation was observed among embryos for all parameters observed in the