distance moved treatments. Longissimus glycolytic potential was also measured after the distance moved treatments on a subset of 32 pigs. Data were analyzed using PROC MIXED and PROC REG of SAS. Handling intensity × distance moved interactions existed (P<0.05) for several blood acid-base measurements. In general, there was no effect of distance moved on these traits when pigs were previously handled gently. However, when pigs were previously handled aggressively, pigs moved 125 compared to 25 m had higher (P<0.05) blood lactate and lower (P<0.05) blood pH, bicarbonate, and base-excess. Pigs transported at 0.39 compared to 0.49 $m^2$/pig had larger (P<0.01) increases in creatine kinase values, however, transport floor space did not affect any other measurements. Data were also analyzed by the number of stressors (aggressive handling, restricted transport floor space, and moved 125 m during handling) experienced by each pig (0, 1, 2, or 3). As stressor number increased, there was a linear increase (P≤0.01) in rectal temperature, blood lactate, and longissimus lactate and a linear decrease (P<0.01) in blood pH, bicarbonate, and base-excess. These data suggest that the stressors evaluated had additive effects on rectal temperature, longissimus lactate values, and blood acid-base balance.

**Key Words:** Pig, Handling, Pre-slaughter Stress

**977 Neonatal Fc receptor mRNA expression in fetal pigs and in gastrointestinal tissues from pigs fed diets of varying form with or without irradiated and non-irradiated spay-dried animal plasma.** C. N. Groesbeck*[1], T. E. Burkey[2], J. E. Minton[1], S. S. Dritz[1], R. D. Goodband[1], M. D Tokach[1], J. M. DeRouchey[1], and J. L. Nelssen[1], [1]*Kansas State University*, *Manhattan*, [2]*University of Nebraska*, *Lincoln*.

The neonatal Fc receptor (FcRn) participates in intracellular trafficking of IgG and the maintenance of circulating IgG. Also, the relationship between the FcRn and IgG may augment host defense immunosurveillance. The current studies evaluated FcRn mRNA from intestinal tissues in fetal pigs and weaned pigs fed meal or pelleted diets with or without irradiated or non-irradiated spray-dried animal plasma. In Exp. 1, fetal pigs were obtained at d 55 and d 70 of gestation (n = 5 fetuses/gestational age) and total RNA was isolated from intestinal tissues for quantitative real-time PCR (qPCR) to determine mRNA for FcRn. FcRn transcripts were observed in all samples, and greater levels of FcRn mRNA were observed in d 55 fetuses compared to d 70 fetuses (P < 0.02). In Exp. 2, weaned pigs were used in an 11-d growth assay to determine the effects of feeding meal and pelleted diets with irradiated or non-irradiated spray-dried animal plasma (AP 920) on FcRn expression in intestinal tissues. Pigs were blocked by weight and randomly allotted in a 2 × 2 factorial to one of four dietary treatments. Main effects were diet form (meal or pellet) and either irradiated or non-irradiated spray-dried animal plasma. Jejunal, ileal, and cecal tissues were collected from 24 pigs at the conclusion of the growth assay. Total RNA was isolated to quantify relative mRNA expression of FcRn. FcRn transcripts were again observed in all samples. FcRn mRNA was more abundant in pigs fed diets containing non-irradiated plasma compared with pigs fed the irradiated plasma (P < 0.02, 1.01 vs 0.57). FcRn mRNA was also more abundant in the pigs fed meal diets than pelleted diets (P < 0.05, 0.98 vs 0.59). The results suggest FcRn varies with gestational age in pigs and with factors affecting dietary bacterial load.

**Key Words:** FcRn Receptor, Irradiation, Pig

## Poultry-Breeding and Hatchery Symposium: Semen Evaulation and Fertility Determination in Poultry

**978 Using sperm penetration values to evaluate broiler breeder performance and reproductive efficiency.** R. K. Bramwell*, *University of Arkansas*, *Fayetteville*.

The sperm penetration assay is a technique developed to quantitatively assess sperm-egg binding and penetration of the perivitelline layer (PL) enveloping the ovum of the avian egg. The process of sperm-egg binding and penetration represents one of the final steps in fertilization sperm must accomplish in order access the female pronucleus for syngamy. Sperm penetration (SP) values have proven to be beneficial for both research and industry applications as these values are based on a sliding scale as opposed to a binary scale for fertility values. As a research tool, male and or female contribution to infertility can be evaluated with much greater accuracy than using fertility values alone. As an industry tool, SP values are used to evaluate broiler breeder flocks experiencing poor hatchability. From identified broiler breeder flocks, each egg from a 50-egg sample is subjected to the SP assay. Holes in the PL overlying the germinal disc caused by sperm-egg binding and the subsequent acrosome reaction are counted and the values recorded in one of five groups (0-10, 11-30, 31-60, 61-100, over 100 holes). Data is expressed as a percentage of the egg samples that produced values in one of the five groups previously reported. For each age group of broiler breeder flocks, an ideal standard has been determined and each flock can be compared to that standard to determine their reproductive efficiency. From this data, the cause of poor performance can be determined and recommendations made improve breeder flock performance.

**Key Words:** Sperm Penetration, Sperm-Egg Binding, Fertility

**979 Advances in sperm cell biology stemming from the analysis of sperm mobility.** D. Froman*, *Oregon State University*, *Corvallis*.

Sperm mobility is a quantitative trait discovered in the mid-1990s. The term *sperm mobility* denotes the net movement of a sperm cell population against resistance at body temperature. The trait was discovered after development of a test based upon sperm penetration of 6% (wt/vol) Accudenz from an overlaid sperm suspension. This test was proven to be simple, objective, and suitable for semen analysis in the field as well as the laboratory. When applied to populations of males, extreme variation was observed among males. Sperm mobility phenotype was independent of age. The relationship between in vitro sperm mobility and male fecundity warranted a systematic analysis. Sperm mobility was proven to be a primary determinant of fertility based upon competitive and non-competitive fertilization. In fact, fertility was a *function* of sperm mobility phenotype. Heritability ($h^2$)

was estimated to be 0.30 using a random bred population. Thereafter, distinct lines were produced by genetic selection. Phenotypic variation evaluated with computer-assisted sperm motion analysis, which described motile properties of individual sperm within populations. Motile concentration and straight line velocity (VSL) were used to predict sperm mobility. Specifically, phenotype was a function of the area within the upper tail of a male's VSL distribution. Consequently, the predictive power of the sperm mobility assay depends on a context in which the *consequences* of variation in VSL become manifest in time. The shape of VSL distributions was explicable in terms of mitochondrial function. In this regard, mobile sperm were rendered immobile by a reagent used to induce the mitochondrial permeability transition pore. Consequently phenotypic variation may be related to $Ca^{2+}$ overloading while sperm pass through excurrent ducts of the testis. As such, a sperm mobility measurement may reflect the proportion of disabled sperm within an ejaculate. Three unexpected experimental outcomes included: (1) a model explaining in vivo sperm storage, (2) the relationship between mitochondrial $Ca^{2+}$ cycling and sperm motility, and (3) a new paradigm for artificial semen storage.

**Key Words:** Sperm Mobility, Sperm Motility, Semen Storage

**980 Using the Sperm Quality Analyzer Vt for dosimetry of turkey semen in commercial turkey operations; the potential impact on fertility, and the economic implications of better utilization of sires with superior growth potential.** K. K. Krueger*, *Diamond K Research*, *Marshville, NC*.

The Sperm Quality Analyzer Vt (SQA Vt) estimates total (TSC) and motile sperm cell (MSC) concentration in either neat or diluted turkey semen. The device is simple to use and results are returned within 3 minutes. No special calibration, operator training, or sensitive reagents are required. Bench trials have confirmed SQA Vt accuracy and repeatability matches or exceeds other methodologies (i.e., hemocytometer, conventional photo spectroscopy, subjective microscopy). Several field trials and ongoing use in properly managed and supervised commercial turkey operations have shown that when dosimetry is based on motile sperm cell number that ~150 million motile sperm per insemination had no adverse effect on fertility. When insemination doses were prepared on motile sperm cell number, fertility was found to be more stable and often improved during the latter weeks of egg production. Dosimetry based on motile sperm cell numbers has been shown to have a positive impact on fertility, but more importantly it allows sires with superior growth characteristics to be used more efficiently and effectively. Unlike the swine and cattle industries where better superior sire utilization is a primary concern, the commercial turkey industry has failed to recognize the potential impact this concept can have on profitability. Identifying males with superior growth and carcass characteristics, managing them for optimum motile sperm cell production, maximum harvest, and motile sperm cell based dosimetry can have a significant impact on genetic progress and economics in the turkey industry.

**Key Words:** Sperm, Motility, Fertility

**981 Using egg breakout to estimate flock fertility.** J. L. Wilson*, *University of Georgia*, *Athens*.

Egg breakout is an excellent tool to estimate flock fertility. This information is used in determining the number of eggs to incubate to meet broiler placements. In addition, egg breakout is a powerful diagnostic tool when flocks are not hatching as expected. It is important to candle eggs between 10-14 days of incubation and open the eggs to determine percentage fertility and early dead embryos. While the end results of low fertility or high numbers of early dead embryos are both low hatchability the causes are distinctly different. Valuable time can be gained in quickly identifying fertility issues and making managerial changes such as spiking the flock to increase fertility. High early embryonic mortality is usually related to egg handling, flock health or chemical exposure. During the candling process other important information can be gathered like the number of eggs in the incubator flat upside down and number of eggs with hairline cracks. Gathering and using egg breakout data to correct low fertility, high embryo mortality, upside down egg placement or loss due to high cracked egg numbers is critical in maximizing chick production.

**Key Words:** Egg Breakout, Fertility, Candling

## Ruminant Nutrition: Nitrogen Digestion/Metabolism

**982 Development and establishment of an enzymatic in vitro procedure for estimating intestinal protein digestibility of feedstuffs for ruminants.** R. Irshaid[1,2] and K.-H. Suedekum*[2], [1]*University of Kiel*, *Kiel, Germany*, [2]*University of Bonn*, *Bonn, Germany*.

This study utilized forty-nine feed samples to develop and establish a completely laboratory-based, enzymatic in vitro procedure (EIVP) for estimating the intestinal protein digestibility (IPD) of rumen-undegradable protein (RUP) of forages and concentrates. Feed samples encompassed forages with varying crude protein (CP) contents, unprotected or rumen-protected protein supplements and cereal grains representing energy-rich feeds of low to medium CP concentration. The EIVP involved the subsequent digestion of samples with a protease from *Streptomyces griseus*, pepsin-HCl, and pancreatin. The concentration of the *S. griseus* enzyme was related to the true protein content of the feed sample. Briefly, the EIVP started with determination of true protein. Feeds were incubated for 18 h in a buffer solution at a constant ratio (41 U/g) of *S. griseus* protease activity to feed true protein. The dried residues were incubated in pepsin-HCl solution for 1 h and residues from this step were incubated with pancreatin solution for 24 h. Samples had previously been used for IPD estimates using a three-step in situ-in vitro procedure (ISIVP) and mobile-bag technique (MBT). The relationships between IPD values estimated by EIVP and ISIVP or MBT were best described by linear regression equations: $IPD_{MBT}$ (g/kg true protein) = 1.221 $IPD_{EIVP}$ (g/kg true protein) - 165.95 ($n = 38$, $r^2 = 0.666$, $P < 0.0001$) and $IPD_{ISIVP}$ (g/kg true protein) = 1.053 $IPD_{EIVP}$ (g/kg true protein) - 28.14 ($n = 49$, $r^2 = 0.985$, $P < 0.0001$). Results from the EIVP closely resembled those obtained with the ISIVP and thus, the completely laboratory-based, standardized EIVP can replace the more invasive ISIVP for estimating IPD of a wide range of feedstuffs for ruminants.

**Key Words:** Protein, Digestibility, Small Intestine