

were cloned into pcDNA3.1 vector and co-transfected with pGL3-CRE luciferase construct into CHO cells. In the presence of these variants (except for 14aa-variant), ovine PACAP38 could strongly increase luciferase activities in a dose-dependant manner with EC50 values lower than 1 nM, suggesting that receptor variants could activate cAMP-PKA signaling pathway. Strikingly, an insertion of 13bp (partial retention of intron 18) into PAC1-R short form and spliced variants results in the cloning of additional 6 spliced variants (with altered C-terminal tails), which could not increase luciferase activities after

PACAP treatment. Moreover, 3 variants (457, 356 and 418aa) (due to deletion of exon 18, or exon 17 and 18) were also cloned from chicken ovary. Again, the insertion of 13bp generates a variant with a C-terminal tail (418aa), while absence of 13bp causes a premature stop codon (356aa). Interestingly, the identical 13bp could also be found in PAC1-R gene of zebrafish and frog, suggesting that it plays a critical role in switching the signaling pathway and determining the splicing pattern of PAC1-R in lower vertebrates.

Key Words: PAC1-R, spliced variant, ovary

Embryo Symposium: Managing the Embryo for Performance

263 Managing incubation: Where are we and why? R. M. Hulet*, *Pennsylvania State University, University Park.*

Improvements in broiler rate of gain for the past ten years have made the incubation period a larger percentage of the overall growth period for commercial poultry and has increased its importance for improving growth efficiency. Historically, hatchery managers have observed decreases in hatchability and chick performance although temperature profiles in the setters and hatchers have not appreciably changed. Decreases in hatchability, first week livability, hatch time, and overall chick quality have precipitated the need for a change in the way hatcheries are managed. Historically, the poultry industry within the US and UK had successfully utilized multi-stage incubation. Currently, use of single-stage incubation in Europe has increased because research has shown they more precisely meet the demands of the developing embryos. Therefore, research has changed the focus for multi- and single-stage hatcheries in order to determine the proper hatchery conditions to optimize embryo development, chick quality, and their affects on post-hatch performance. Studies have investigated how increases in shell temperature, independent of machine temperature, can result in increases in embryonic mortality, lower heart yield (heart / body weight), lower yolk-free body weight, and increased yolk weight. Factors that have contributed to the increase in heat stress to the developing embryos include egg mass, age of the embryo, air flow, breeder flock fertility, etc. Other studies have shown that the variation in chick performance can be explained by heat stress in the hatchery. Therefore, the symposium will show how improvements in our knowledge of the requirements of the developing embryo can help improve not only hatchability and first week livability, but post-hatch performance of commercial poultry.

Key Words: shell temperature, post-hatch performance, hatchery management

264 Incubation parameters and chick quality. R. Meijerhof*, *Nutreco, Boxmeer, The Netherlands.*

Hatch results give an underestimation of the influence of the incubation process on the total production chain, as the influence of the quality of the day old chicken and with that of the incubation process on the performance parameters of broilers is significant. Therefore, the quality of the incubation process should be much more expressed in terms of development and quality of embryos then in chicks of (fertile) eggs set. The major contributing factor to the quality of the day old chick is the embryo temperature. This temperature is the result of the

balance between heat production of the embryo on one side and air temperature, heat capacity of air, air velocity and water evaporation on the other side. A lack of control of the embryo temperature results in a dramatic decrease in chick quality and broiler performance. Several attempts have been made to quantify the quality of the day-old chick in an easy and repeatable way. The length of the chicken has shown to be a useful and practical applicable tool, as it is related with the performance potential of the bird. More qualitative scores as the Pasgar or Tona score are useful as well, but focus more on the survival opportunity in the first week of the broilers life then on the performance potential.

Key Words: incubation parameters, chick quality

265 Attainment of thermoregulation. B. Tzschentke*, *University of Berlin, Humboldt, Germany.*

In poultry the early development of adaptive body functions, like the thermoregulatory system, is characterized by the following peculiarities.

I The development of peripheral as well as central nervous thermoregulatory mechanisms starts in the course of the prenatal ontogeny. However, their maturity is attained during early postnatal development. In the perinatal period environmental factors have a high impact on development of temperature regulation.

II Acute changes in the environmental conditions induce as a rule, first uncoordinated and immediately non-adaptive reactions. Later the uncoordinated (immediately) non-adaptive reactions change into coordinated (adaptive) reactions. Prenatal environmental influences may have a 'training effect' on the postnatal efficiency of the thermoregulatory system. These 'training effects' are necessary for the complete development of body functions like thermoregulation.

III Functional systems of the organism develop from open loop systems without feedback control into closed systems controlled by feedback mechanism. During this 'critical period', the actual environment modulates the development of the respective physiological control systems for the entire life period, especially by changes in neuroorganization and expression of related effector genes. Knowledge on these mechanisms might be specifically used to generate long-term adaptation of the organism to the postnatal climatic conditions (epigenetic temperature adaptation: ETA). In poultry ETA was developed by changes in the incubation temperature. Compared to birds, which were incubated at 37.5°C, a low incubation temperature induced postnatal cold-adaptation and warm incubation temperature induced postnatal heat-adaptation. ETA was shown in changes in the neuronal

thermosensitivity in the hypothalamus as well as in changes in peripheral thermoregulatory mechanisms. These alterations could be already found at the end of incubation. Further, changes in the level of circulating hormones as well as in expression of genes and transcription factors were found.

Key Words: temperature regulation, environmental factors, epigenetic temperature adaptation

266 The endocrine interface of environmental and egg factors affecting chick quality. E. Decuypere* and V. Bruggeman, *Catholic University, Leuven (Heverlee), Belgium.*

Day-old chicks are the end product of the hatchery industry and form important starting material for the broiler farms. The major objective is to obtain a high hatchability of marketable chicks and a low spread of hatch. For the farmers, these chicks have to perform good, which is translated in high viability, high growth rate, high breast meat yield and low feed conversion. A good quality one-day old chick is hence a crucial hinge between the hatchery and the broiler farm. Moreover, maximal hatchability is not always synonymous with maximal post-hatch viability and growth potential of the chick. Quantitative and qualitative scoring of chick quality is assessed and some recently developed scoring systems, converting differences in qualitative parameters into a quantitative score are briefly discussed. Pre-incubation factors such as egg storage duration and age of broiler breeders, as well as incubation conditions will affect day-old chick quality and subsequent broiler performance. Heat production and metabolism, hormonal balances of thyroid hormones and corticosterone and gas exchange (O₂, CO₂) are of fundamental importance for embryonic development and survival during incubation. Results from our studies indicate that embryos with higher pCO₂ levels in the air cell, and higher T₃/T₄ ratios at internal pipping or in the newly hatched chicks had higher hatchability, chick quality and post-hatch chick growth until 7 days. Incubation factors such as temperature, turning conditions or gaseous environment also affect development, change concentrations of hormones related to metabolism and growth of the embryo, and in this way affect one-day old chick quality. Moreover, also the spread of the hatch process is affected by incubation conditions as well as by the aforementioned pre-incubation factors.

Depending on the spread of the hatching curve together with the place in the sequence of hatching (early or late) and in interaction with quality of the eggs set for incubation, storage duration, age of breeders,... there will be a period between hatch and first feeding of variable length. This may have repercussions on overall growth and a number of related physiological processes such as yolk uptake, metabolic 'level', gastrointestinal development,... In its turn, this is related to some crucial hormone levels and enzyme activities for

growth that are strongly influenced by post-hatch food intake such as insulin and p70S6 kinase activity, a key enzyme in the control of protein synthesis. The magnitude of the effect of delayed feeding is dependent on the spread of hatching as well as on the hatching period within the hatching window. This may be related to the different intrinsic quality or characteristics of chicks, e.g. early vs. late hatchers, as was shown by their respective hormonal levels. The latter may be a causal factor for the actual hatching time within the hatching window as well as for the later intrinsic quality of the hatched chick and which is not reflected in any of the actual scoring systems for chick quality. This is largely ignored in previous studies and in hatchery practice so far.

Key Words: chick quality, endocrine parameters, interfering factors

267 Nutrition of the developing embryo and hatchling. E. Moran*, *Auburn University, Auburn, Alabama.*

Nutrient need by the embryo undergoes three abrupt changes from the initiation of incubation until complete dependence on feed. Glucose is the central nutrient until 7 days when chorioallantois oxygen enables use of lipid reserves to support subsequent development. Nutrient recovery from albumen and yolk is largely proportionate to assembly of the complete embryo through to 14 days. Thereafter, nutrient transferred to the body proper exceed the needs for growth and are intended as reserve in support of eventual emergence and short-term survival. Sero-amnionic sac rupture mixes albumen in the amnion for actual consumption by the embryo. The small intestine absorbs a large portion of this colostrum equivalent to foster extensive glycogen storage in liver and hatching muscle. Concurrent recovery of yolk lipid enlarges specific body depots and cholesterol in the liver. A rapid translocation of calcium from shell to long bones gives physical integrity for the rigors of hatching while a substantial quantity is complexed in the yolk sac with lipovitelline-phosvitin granules. Loss of the chorioallantois with pipping initiates pulmonary respiration, and oxygen becomes restricted when energy need maximizes. Anaerobic metabolism of glucose from glycogen reserves now becomes essential to fully supporting emergence. The GI system must also reorient itself from macromolecule transfer to foodstuff digestion during the next 7 days. Mobilizing body fat complements diminishing yolk sac contents that not only provides a continuum of energy but generates heat and water. Vast hepatic cholesterol appears to relieve its need for synthesis during rapid formation of membranes with initial growth. Calcium-phosphoprotein granules also evacuate the yolk sac to assure interim skeletal development. Weight of the egg, age of the hen, and her nutrition influence many aspects of these transitions.

Key Words: albumen, embryo nutrition, yolk sac