**Symposium: Oxidative stress**

**612S  Efficiency and oxidative metabolism: The difficult balance.** Walter Botje*, University of Arkansas, Fayetteville, AR.

Understanding the regulation of oxidative metabolism appears key to develop highly efficient birds. An extensive review of the global gene and protein expression data sets obtained from muscles of high and low feed efficient (FE) birds allowed to identify the relationships between genes/proteins and feed efficiency. The analysis is also enlarged to take into account all data involved (directly or indirectly) in antioxidant protection of cells. Such an approach of investigating the relationship between feed efficiency, redox balance and antioxidant capacity is the only way to refine the understanding of feed efficiency in poultry production. Recent data have been obtained on NFE2L2 (previously referred to as Nrf2) that orchestrates antioxidant response to oxidative stress. Indeed investigating the gene expression for NFE2L2 in tissues from quail and broilers individually phenotyped for feed efficiency shows strong relationships thus indicating their roles as major regulators. However some downstream targets (SOD1, SOD2 and glutathione peroxidase) were also identified. Redox balance is clearly a strong modulator of feed efficiency that should be better taken into account for improving bird performance and productivity.

Key Words: PSA

**613S  Nutritional modulation of the antioxidant capacities in poultry.** Peter Surai*, Feed-Food Ltd, Scotland, United Kingdom.

Antioxidant system of poultry includes 3 major levels of defense. The first line is based on antioxidant enzymes, including SOD, GSH-Px and Catalase. The second level of defense is built by natural antioxidants, including vitamin E, but they perform only first part of the job detoxifying peroxyl radical (ROO*) and producing hydroperoxide ROOH which is still toxic and must be detoxifying by Se-GSH-Px. The third level of antioxidant defense is based on specific enzymes involved in repairing various molecules damaged by free radicals. In the body, all antioxidants are interacting with each other providing a team work, called antioxidant defense. In this team every member has its own job to do and Se is called chief executive of antioxidant defense. A major strategy of nutritional modulation of antioxidant defenses includes adding antioxidant into the poultry diet. This includes, vitamin, selenium, carotenoids, flavonoids (polyphenols) and some other antioxidants. Analysis of research data on modulation of antioxidant defenses by increasing levels of antioxidants in poultry diets indicates that Se has a special role, since its efficacy depends on the form of Se (organic vs inorganic) used in the supplement. Indeed, it has been proven that major effect of dietary Se is related to building Se reserves in the body in the form of SeMet which can be used in stress conditions when Se requirement increases but feed consumption usually goes down. Therefore, stresses increase proteasome activities dealing with protein catabolism releasing SeMet which is an additional source of Se for selenoprotein synthesis, giving additional protection. The main dietary strategy is to transfer as much as possible Se to the muscles (building Se reserves in breeders, layers and broilers) and to the egg, improving antioxidant defenses of the developing embryo at time of hatching, a stressful period in chicken life. Therefore, a comparison of efficacy of different forms of Se in the maternal diet as well as in chicken diet is an important point to be addressed. In conclusion, the choice of effective antioxidants is the most important step in building antioxidant defense program for poultry. However, some well-advertised natural antioxidants based on plant extracts are not proven to be antioxidants in biological systems. Therefore, there is a lot of food for thoughts for a poultry nutritionist.

Key Words: PSA

**614S  From oxidative stress to Inflammation: Redox balance and immune system.** Charlotte Lauridsen*, Aarhus University, Tjele, Denmark.

The purpose of this lecture is to review the role of dietary vitamins, fatty acids and antioxidant in relation to gut health and productivity of animals. The importance will be given on the immune response in relation with redox balance and antioxidant potential. Special emphasis will be given to the role of the nutrients and bioactive substance in the modulation and prevention of oxidative stress and inflammatory reactions in relation to infectious diseases such as post weaning diarrhea in piglets or oxidative challenged chicks.

Key Words: PSA

**615S  Avian selenogenome: Response to dietary Se and protection against oxidative insults.** Xingen Lei*, Cornell University, Ithaca, New York, United States.

Selenium (Se) is an essential nutrient of trace element for humans and all food-producing animal species. Nutritional deficiencies of Se and(or) vitamin E induce exudative diathesis, nutritional pancreatic atrophy, and nutritional muscular dystrophy in chicks. Metabolic roles of Se are presumably attributed to its presence as the 21st amino acid, selenocysteine (Se-Cys, U) in selenoproteins. A total of 26 selenoprotein genes were identified in avian species. Differential regulations of the whole selenogenome expression by different concentrations and(or) chemical forms of dietary Se have been studied in broilers and turkeys. The 3 classical Se/vitamin E deficiency diseases could be replicated in broiler chicks by feeding them a practical corn-soy diet produced in the Se-deficient area. Subsequently, 7 selenoprotein genes (Gpx1, Gpx4, Selenow, Selenon, Selenop, Selenoo, and Selenok), coding for oxidation- and/or lesion-protective proteins, were found to mediate the protection conferred by dietary Se against exudative diathesis. Likewise, 6 selenoproteins, namely SELENOP, GPX1, GPX4, SELENOF, SELENOW, and SELENON, were shown to exert a similar role in the protection against nutritional muscular dystrophy.

Key Words: PSA

**616S  Meat: From muscle to food—Oxidative challenges and developmental anomalies.** Michael Lilburn*, Ohio State University, Wooster, OH.

Free radicals can be generated in mitochondria as a byproduct of normal oxidative metabolism and subsequently initiate the formation of reactive oxygen species (ROS) such as hydroxyl radicals and the superoxide anion. The generation of ROS can lead to the production of hydrogen peroxide and the subsequent generation of more hydroxyl radicals. These same free radicals, however, can also be the co-products of cellular metabolism and have been implicated in a host of human health issues. With respect to animal nutrition, Vitamin E has been extensively researched for its role in maintaining cell membrane integrity in vivo, prolonging the shelf-life of muscle products and facilitating several
immune response mechanisms. Vitamin E, however, does not work in a vacuum. It has long been recognized that there is a coordinated “anti-oxidant” system which includes direct effects of Vitamin C and indirect roles for Se, Mn, Cu and Zn as cofactors for selected anti-oxidant enzymes (i.e., glutathione peroxidase; superoxide dismutase). Recently, “oxidative stress” has been implicated in the etiology of a breast muscle anomaly in poultry called “white striping/woody breast.” There is a hypothesis that the extensive accretion of breast muscle protein in a poorly vascularized “white muscle” overwhelms the in vivo mechanisms for coping with the excessive production of ROS in heavy, high yielding birds. Recent gene expression data supports this hypothesis.

Key Words: PSA