575 Skin Color Evaluation in Broilers Fed Natural and Synthetic Pigments. S. M. P. Castaeda*, E. M. Hirschler, and A. R. Sams, *Texas A&M University, College Station, TX.*

Broiler carcass skin color is important in the USA and Mexico. Because pigments are expensive, this study evaluated the use of natural and synthetic pigments in broiler diets at commercial levels. In two trials, 280 chicks were randomly distributed (20 birds each) into seven treatments according to the pigment class (natural or synthetic) and the inclusion level (ppm of pigments) of yellow (apoester) and red (canthaxanthin) pigments. Two treatments were designed to mimic current commercial practices in the USA and Mexico. The treatments were: control (no pigment); natural-low level, natural-high level, synthetic-low level, synthetic-high level, a common USA level, and a natural-synthetic blend used in Mexico. Diets were started at week 3 and feed consumption, body weight, skin color, and blood pigment level were evaluated weekly from weeks 3 to 7. At 49 d of age the birds were processed and skin color was measured after picking and chilling. The natural pigments had consistently greater skin b∗ values (yellowness) than the synthetic pigments. The high levels produced greater skin b∗ values than the low levels, regardless of source. The synthetic pigments had a slower increase in skin b∗ but reached the same level as the natural-low by 7 wks. There was no difference in skin a∗ values (redness) due to pigment source or level or the age of the bird. By 7 wks, all pigment sources approached plateau levels in the blood but the synthetic pigment diet had higher blood levels of both yellow and red pigments than the natural pigment diets. Processing intensified skin yellowness and reduced skin redness. These data suggest that natural pigments were more efficient at increasing skin yellowness and that there were only small differences between high and low levels for each pigment source. This may allow a reduction in pigment use and feed cost to achieve the same skin acceptance by the consumer. color, pigment, carotenoid, skin, broiler

Key Words: Color, Pigment, Carotenoid

576 Mechanisms of pink color formation in irradiated precooked turkey breast. K. C. Nam*, M. Du, H. Ahmed, S. J. Hur, Y. H. Kim, and D. U. Ahn, *Iowa State University.*

Irradiation produces pink color defect in precooked poultry breast meat. The chemical pigment form of the pink color in irradiated, precooked poultry meat has not been identified. According to our preliminary study, irradiation decreased oxidation-reduction potential (ORP) and produced gas compounds that can act as a sixth ligand of heme pigments. Therefore, we hypothesize that production of certain gas compounds and increased reducing conditions induced by irradiation may be responsible for the red/pink color formation in precooked irradiated turkey breast. The objectives of our study were to characterize color compounds generated by irradiation, and to determine the effects of packaging and storage on color production in precooked turkey breast. Precooked turkey breast muscles were aerobically or vacuum-packaged and then irradiated at 0, 2.5, or 5.0 kGy using a Linear Accelerator. The CIE color, reflectance, ORP, gas production, and lipid oxidation of samples were determined at 0, 7, and 14 days of storage. Irradiation dose-dependent increase of pink color was found in mainly vacuum-packaged samples, and the increased pink color did not decrease during vacuum-packaged storage. Irradiation decreased ORP and produced carbon monoxide (CO) indicating that the pink color of irradiated precooked turkey breast was caused by the decreased ORP and heme pigment-CO complex formation. The reflectance of meat and the absorption spectra of myoglobin solution derivatives supported that denatured CO-myoglobin would be the pigment responsible for the pink color in irradiated precooked turkey breast. Lipid oxidation was not directly related to the pink color intensity of precooked irradiated turkey breast.

Key Words: Irradiated color, Carbon monoxide, ORP, Precooked turkey breast

577 Effects of selected chemicals on red discoloration in fully cooked broiler breast meat . D. P. Smith*[1], J. K. Northcutt[2], and J. R. Claus[3], [1]*USDA Agricultural Research Service, Athens, GA 30604,* [2]*University of Georgia Department of Poultry Science, Athens, GA 30602,* [3]*University of Wisconsin-Madison, Madison, WI 53706.*

Two replicate experiments were conducted to determine effects of selected chemicals on red discoloration in uncured, fully cooked broiler breast meat. Breast fillets and femurs were removed from commercial broilers after chilling. Fillets were finely chopped and the meat was divided into five portions for treatment additives: No additive (Control); 0.3% ascorbic acid; 0.3% citric acid; 200 ppm ethylenediaminetetraacetic acid (EDTA); and, 3% nonfat dry milk (NFDM). One g of bone marrow, prepared by chopping and grinding primary spongiosa from the femurs, was added to the middle of ten g portions of meat, which were then placed into each of five replicate tubes. Tubes were cooked to an internal temperature of 76.6 C, immediately cooled, and meat was removed. Color values (CIE L*, a*, and b*) were measured in triplicate on the meat surface adjoining the marrow. Lightness (L*) ranged from 45.5 to 51.3, redness (a*) ranged from 23.4 to 28.9, and yellowness (b*) ranged from 14.4 to 16.8. Citric acid (a* = 23.4) and EDTA (a* = 23.8) significantly ($P < 0.05$) reduced redness compared to Control values (a* = 27.4). Neither ascorbic acid (a* = 24.8) nor NFDM (a* = 28.9) reduced redness values when compared to Control values, although ascorbic acid redness values were significantly lower than NFDM. These data show citric acid and EDTA significantly reduced redness in this experiment, whereas ascorbic acid and NFDM did not reduce redness values.

Key Words: Cooked breast meat, Red discoloration, Bone marrow

Animal Products in Today's Diet

578 The nutritional contributions of animal products to the US diet - The USDA Food Pyramid and Dietary Guidelines. Donald. J. McNamara, Ph.D.*[1], [1]*Egg Nutrition Center.*

Seems all one ever hears about dietary recommendations is "eat more whole grains, more fruits, more vegetables" and nary a good word about milk, beef, pork, chicken, eggs or the other animal products in the diet. Too many so called nutrition experts put animal products in the "bad food" group based on fat and cholesterol without recognizing the wealth of contributions these products make to a healthy and nutritious diet. There are good reasons why animal products hold important places in the USDA Food Guide Pyramid and in the Dietary Guidelines for Americans, and no matter what the fat/cholesterol-phobic and animal rights activists say, the evidence is clear that the diet is more nutritious, and more enjoyable, with the inclusion of animal products in a balanced diet.

Key Words: Animal products, Nutrition, Dietary guidelines

579 Modified protein diets. E. Hentges*, *National Pork Producers Council.*

Diets higher in protein have gained popularity in the U.S. and other developed countries for several reasons. Hentges will discuss the protein diet effects on insulin resistance, serum lipids, and weight control. He will also discuss the effects this diet has had on the industry and the response from national health organizations.

Key Words: Protein, Diets

580 Designer foods. D.C. Beitz* and T.J. Knight, *Iowa State University.*

Governmental agencies and human health associations have made specific and general recommendations for consumers to improve their health by changing their diet. Animal scientists have responded with a variety of nutritional, genetic, and management tools that can be used to redesign meat, milk, and eggs compared with previously produced products. But, to continue to meet consumer demands and to make animal-derived foods even more appealing, animal scientists must continually strive to modify animal food composition and quality to meet

the evolving recommendations being offered. Although, most modifications address a specific recommendation, other characteristics of the products may also be negatively altered. For example, should production systems be modified to increase the polyunsaturated fatty acids, conjugated linoleic acids (CLA), and omega-3 fatty acids and how will these changes affect shelf-life of the products? Should we attempt to decrease cholesterol content of animal foods? How can animal-derived foods be modified to contain greater concentrations of endogenous and of exogenous compounds to improve healthfulness of the resulting foods? Experiments that result in greater concentrations of polyunsaturated fatty acids including CLA and omega-3 acids and lesser total fat content in animal foods will be described. The influence of dietary fats and vitamin D on food quality, specific breeding programs, and molecular biological procedures that can be used to make specific changes in composition of animal foods will be described and specific examples will be given.

Key Words: Designer foods, Food quality, Fat composition

581 Designer foods: egg products. Hilary Shallo*, *Egg Nutrition Center*.

Last year, 158 million American - 85% – used a dietary supplement. Whether to simply maintain health or manage/treat a condition, nine out of ten shoppers prefer naturally nutritious foods to supplements (FMI/Prevention,1999; HealthFocus 1999). In its efficient ovoid container, eggs are naturally a functional food providing valuable nutrients, from their high-quality protein to significant levels of beneficial vitamins, antioxidants, and other healthful compounds. In addition to the eggs being a natural functional food, the egg's nutrient content can be altered by the feed given to chickens. Consumers can now find eggs with even less cholesterol and saturated fat than typical and with an added bonus of increased vitamin E and DHA. And processors are beginning to make similar products available on an industrial level. Dr. Hilary Shallo will discuss the new nutrient-enhanced egg products that are available in the marketplace.

Key Words: eggs, designer eggs

582 Dairy Foods and Ingredients - Nutritious and Functional Products for the Food Industry and the Consumer. P. Tong*[1] and C. Podgurski[1], [1]*Dairy Products Technology Center, California Polytechnic State University*.

Milk and the products made from milk are known to offer consumers good nutrition and good taste. Technologies continue to improve for the processing of milk into highly functional dairy ingredients for the food industry. In addition, consumer interest in health promoting foods is increasing. As a result dairy ingredients are widely used in formulating baked goods, nutritional beverages, confections, sauces and other foods for today's consumers. As our understanding of the biological function of individual milk components improves, a whole new line of bio-active, functional dairy foods and ingredients are emerging. These specialized dairy ingredients are being used in foods which are thought to improve overall health (e.g., immune function, intestinal health, blood pressure regulation, etc.).

Key Words: dairy foods, milk, nutrition

583 Product Overview: Meat Products. D. H. Beermann*, *University of Nebraska, Lincoln*.

Linkages between nutrients in foods and human health have long been used as a basis for dietary recommendations. The Dietary Guidelines and the Food Guide Pyramid provide guidance through identity of basic food groups and suggested relative daily intakes. Concerns about total fat, saturated fat, and cholesterol content of meat and meat products spurned suggestions in the 1980s and 1990s that intake of meat and meat products be reduced. Although these recommendations lacked credence because daily contributions to the diet relative to dietary guidelines were not described for meat and other foods, consumers responded to these suggestions. This prompted research investigations directed at discovering strategies or technologies that improve fat-to-lean ratio, fatty acid composition, and altered concentrations of other nutrients. Success in altering carcass and retail cut composition was achieved through genetic selection, genomic analysis, administration of metabolism modifiers (somatotropin, beta-adrenergic agonists, conjugated linoleic acid (CLA)) and improving diet formulations to more closely match nutrient requirements of livestock. Technologies were developed for reducing fat content and altering nutrient composition of manufactured meat products. Examples of these are discussed. The discovery of the anti-carcinogenic, anti-tumorogenic, anti-diabetic effects of the cis-9, trans-11 isomer of CLA led to investigations of strategies for elevation of CLA concentrations in lipid depots of meat animals, primarily through dietary manipulation strategies. Feeding full-fat extruded soybeans at a level of 25% of the diet increased CLA cis-9, trans-11 15 to 20% in steers, but in other studies, feeding 6% yellow grease doubled concentration of the isomer. Comparison of results of several unpublished studies is presented.

Key Words: Designer Meat, Fat, CLA

Contemporary Issues in Sheep Production and Research

584 Outlook for wool markets in the 21^{st} century. C. J. Lupton*, *Texas Agricultural Experiment Station, San Angelo*.

Wool's current market share of world fiber production is 3% with man-made fibers having 59% and cotton 38%. Raw material prices, processing costs, fashion trends, and fiber characteristics are all major factors in the global fiber competition for market share. In the past 15 yr, world production of wool has declined by 662 thousand tonnes from 3002 during the 1985/1986 season to 2340 in 1999/2000. During this time, production actually peaked at 3358 thousand tonnes in the 1990/1991 season. This high level of production, historically high prices, political and economic turmoil in the USSR and some eastern European countries, war in the Middle East, a drastic reduction in purchases by China, and the onset of recession in several major market countries combined to force suspension of the Australian Reserve Price Scheme in February, 1991, (a stabilizing factor on wool prices for the previous 17 yr). The concurrent accrual of a large wool stockpile (4.7 million bales in Australia alone) without price support resulted in an immediate downward adjustment in wool prices (35%). The effects of these events are still being felt. Slowly, the balance between supply and demand is being restored at price levels that will permit profitable production. Low prices have caused many producers to leave the sheep business. On the other hand, low prices have made wool more attractive to textile processors, and have helped wool retain some of its market share. Raw wool prices are now forecast to increase moderately over the next 10 yr because of lower supply, modest improvements in demand, and increasing numbers and affluence of consumers. In future, production and manufacturing is expected to be concentrated in those countries that can produce and process it at the lowest cost. The high standard and cost of living in the US, high labor costs, increasing land values, greater public concern for the environment and the well-being of wildlife including predators, the expectation of younger generations for more comfortable lives, and sheep's inability to adapt well to large-scale, indoor factory operations all lead me to believe a decreasing proportion of wool and lamb will be produced domestically. Imports will supply the predicted moderate increases in demand by U.S. consumers for wool and lamb.

Key Words: Wool, Wool Markets, Sheep

585 Current status of genomic tools for genetic improvement in sheep. B. A. Freking*, *USDA, ARS, U.S. Meat Animal Research Center, Clay Center, NE*.

Rapid accumulation of genomic sequence data from a variety of mammalian species has led to increased knowledge of the structural organization and function of genes which impact production traits in livestock species. Tremendous genetic variation exists within and between sheep breeds for many economically important traits. Identification of the specific allelic variation would allow efficient use of DNA-based technologies to enhance information used to predict breeding values. The existing genetic map based on microsatellites is useful for initial scans of the sheep genome, but lacks comparative information on positional candidate genes. Current efforts in gene discovery have generated substantial