8 Real Problems in the Virtual World. E. L. Knox*, .

Professor Knox has taught in the virtual world since 1995 and has been a denizen of the Internet since 1986. He has seen first-hand the benefits of the virtual classroom, but he has also seen the problems at close range. In this presentation he will talk frankly and in detail about the kinds of problems that attend using the Internet as a medium for teaching. Many of his remarks will reflect his experiences teaching history in a fully virtual environment, but his experience as the webmaster for Boise State University allows him to address other perspectives as well-those of the hard sciences, for example, and of those who use the Internet as an adjunct to live classes.
The talk will cover three main areas: technical issues, pedagogical issues, and administrative issues. Throughout, the focus is on the individual instructor and his or her students. Technical issues include choice of tools, bandwidth and performance, reliability, and various forms of media. Administrative issues include training, intellectual property and copyright, class size, and university support services. Most important, however, are the pedagogical issues. Professor Knox will speak to the difficulties of student training, trading away class time to teach computing, how to grade on-line discussion, academic honesty, and maintaining scholarly standards.

While the problems are real, on-line teaching is indeed viable. There are real problems in the real classroom, too.

Key Words: Internet, Virtual Classroom, Pedagogy

Tuesday, AM, John Q. Hammons Hall III, PUFA Symposium

9 Human requirement for n-3 polyunsaturated fatty acids. A. P. Simopoulos*, *The Center for Genetics, Nutrition and Health, Washington, D.C.*

The diet of our ancestors was less dense in calories, being higher in fiber, rich in fruits and vegetables, and consisting of lean meat and fish. As a result, the diet was lower in total fat and saturated fat, but contained equal amounts of n-6 and n-3 essential fatty acids (EFA). Linoleic acid (LA) is the major n-6 fatty acid and alpha-linolenic acid (LNA) is the major n-3 fatty acid. In the body, LA is metabolized to arachidonic acid (AA), and LNA is metabolized to eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). The ratio of n-6 to n-3 EFA was 1-4 to 1 with more longer chain PUFA than today's diet. Furthermore, the diet contained small but roughly equal amount of n-6 and n-3 PUFA, whereas today this ratio is about 10 to 1 to 20-25 to 1, indicating that Western diets are deficient in n-3 fatty acids compared with the diet on which humans evolved and their genetic patterns were established.
The n-3 and n-6 EFA are not interconvertible in the human body and are important components of practically all cell membranes. N-6 and n-3 fatty acids influence eicosanoid metabolism, gene expression, and intracellular cell communication. The PUFA composition of cell membranes is to a great extent dependent on dietary intake. Therefore, appropriate amounts of dietary n-6 and n-3 fatty acids need to be considered in making dietary recommendations, and these two classes of PUFAs should be distinguished because they are metabolically and functionally distinct and have opposing physiological functions. Their balance is important for homeostasis and normal development. Studies with nonhuman primates and human newborns indicate that DHA is essential for the normal functional development of the retina and brain, particularly in premature infants.
A balanced n-6/n-3 ratio in the diet is essential for normal growth and development and should lead to decreases in cardiovascular disease, other chronic diseases, and improve mental health.

Key Words: N-6 and n-3 essential fatty acids, N-6/n-3 ratio, Requirements, Normal development, Chronic diseases

10 Feed Modifications for the Docosahexaenoic Acid Enrichment of Poultry. M. E. Van Elswyk*[1], [1]*OmegaTech, Inc.*

Consumption of the long-chain omega-3 fatty acid, docosahexaenoic acid (DHA;22-6n-3), in the U.S. is estimated at 150 mg daily. Many international groups recommend at least 1 g daily to support good health. Given the responsiveness of poultry meat and eggs to changes in dietary fatty acids, enriched poultry could help narrow the discrepancy between DHA intakes and reccomendations. Direct sources of DHA for poultry supplementation include fish oil or marine algae. Flaxseed supplies linolenic acid (18:3n-3)which has a limited capacity to be further metabolized to DHA in the body. The following will discuss the usefulness of DHA-rich marine algae as a poultry fed supplement. Supplying 230 mg of DHA daily to hens from Gold DHA^{TM}increases egg yolk DHA to 150-175 mg per egg. This would represent DHA levels 8-9 times higher than that of ordinary eggs and 75% deposition efficiency from the diet. Importantly, only algal sources supply this level of DHA without potential for off-flavors. Golden marine algae also contributes to the darkening of yolk color. Supplying broilers with 245 mg of DHA from Gold DHA^{TM} yields breast meat with 75 mg of DHA per 100 g without adverse changes in shelf-life. This increase would represent DHA levels 5 times higher than that found in typical broiler meat. The use of dried algal products such as Gold DHA^{TM}in poultry feed provides a pure, sustainable, and stable resource for increasing DHA in the U.S. diet via poultry.

Key Words: Docosahexaenoic acid, egg fatty acid modification, meat fatty acid modification, omega-3 fatty acids, marine algae

11 Enriched Eggs as a Source of Omega-3 Fatty Acids for Humans. N. Lewis* and S. Seburg, .

Dietary intake of omega-3 fatty acids (n-3 PUFA) decreases the risk of heart disease, inhibits the growth of prostate and breast cancer, delays the loss of immunological functions, and are required for normal fetal brain and visual development. The U.S. has not established a Recommend Daily Intake for n-3 PUFA. However, Canada has established the Canadian Recommended Nutrient Intake (CRNI) at 0.5% of energy. Dietary sources of n-3 PUFA include fish, chicken, eggs, canola oil, soybean oil. Food consumption studies in the U.S. indicate that the majority of Americans do not meet the CRNI for n-3 PUFA. Mean n-3 PUFA consumption was 78% of the CRNI for midwestern women during pregnancy. In midwestern women at risk for breast cancer, the mean n-3 PUFA consumption is approximately 50% of the CRNI. Increasing the consumption of n-3 PUFA requires identification of a food source that the public would eat in sufficient amounts to meet recommended intake. N-3 PUFA enriched eggs can be produced by modifying hens' diets. When 70 g/kg of cod liver oil, canola oil, or linseed oil are added to a commercial control diet, the n-3 PUFA are increased from 1.2% of egg yolk fatty acids to 6.3, 4.6, and 7.8%, respectively. Feeding flaxseed increases linolenic acid in the egg yolk about 30-fold and docosahexainoic acid, increases nearly 4-fold. When individuals are fed four n-3 PUFA enriched eggs a day for four weeks, plasma total cholesterol levels and LDL-C do not rise significantly. Plasma TG are decreased by the addition of the n-3 PUFA enriched eggs to the diet. N-3 PUFA may influence LDL particle size, causing a shift toward a less atherogenic particle. Blood platelet aggregation is significantly decreased in participants consuming n-3 PUFA enriched eggs. Overall results of studies to date demonstrate positive effects and no negative effects from consumption of n-3 enriched eggs. Three n-3 PUFA enriched eggs provide approximately the same amount of n-3 PUFA as one fish meal. It is recommended that n-3 PUFA enriched eggs be used as one source of n-3 PUFA to increase individual consumption to meet the current Canadian recommendations.

Key Words: Omega eggs, Omega-3 fatty acids, Alpha linolenic acid, DHA (docosohexanoic acid), Serum lipids

12 Eggland's Best, Inc.: A Specialty Egg Marketing Success. C. T. Lanktree*, G. A. Storbakken, S. M. Michella, and B. T. Slaugh, *Egglands Best, Inc., King of Prussia, PA.*

Eggland's Best, Inc. markets premium quality shell eggs under the Eggland's Best (EB) brand name. The company, started in 1988, is comprised of a franchise network of established egg producers which covers most of the United States. EB provides its franchisees with marketing and technical support. The franchisees produce, process and distribute Eggland's Best eggs according to the strict program established and monitored by EB. Production follows the all-natural vegetarian feed program in accordance with the company's U.S. patent entitled "Eggs Compatible with a Cholesterol Reducing Diet and Method of Producing the Same." The EB program excludes animal fat and other animal by-products. EB eggs have seven times the generic level of vitamin E, nearly 3 times more

omega-3 fatty acids and iodine, and 25% less saturated fat than regular generic eggs. EB has one of the finest shell egg quality assurance programs anywhere. EB franchisees submit weekly egg samples, which are analyzed for shell quality, interior quality, vitamin E, iodine, cholesterol and fatty acids. Samples of feed and the EB patented feed supplement are also analyzed. Approximately 28,000 total laboratory tests are conducted annually. Nationwide product and display retail evaluations are contracted through an outside audit company (40-50 cities evaluated 4 times per year). All EB eggs are USDA graded according to EB's strict quality standards. Producers must follow a food safety quality assurance program (UEP 5-Star, or equivalent state or company program). Each egg is stamped "EB" as assurance of meeting EB's highest standards of flavor, quality and nutrition. Eggland's Best has enjoyed record sales growth for the past three years.

Key Words: Education, Symposium, Egg, Marketing, Quality

Tuesday, PM, John Q. Hammons Hall II, Camphylobacter Symposium

13 Regulatory Issues Related to *Campylobacter* on Poultry.

J. E. Marion*[1] and S. Pretanik[2], [1]*Auburn University, AL,* [2]*National Chicken Council, Washington, DC.*

Regulatory issues related to *Campylobacter* on poultry currently hinge on the state of scientific knowledge, USDA-Food Safety and Inspection Service (FSIS) goals, field data, incidence and severity of illnesses related to poultry and red meats, and the overall mix of consumer, political and industry input.

Scientific knowledge on *Campylobacter* in poultry is being advanced at a rapid rate. Universities, USDA-ARS, and other agencies are conducting research to determine the source of *Campylobacter* in poultry, how it may be controlled and monitored, and its' relation to human diseases. Information is also being generated by the poultry industry via in-plant studies, by FoodNet and by others. Some of studies reach from the farm to the table. It is likely that USDA-FSIS will establish final product performance standards for *Campylobacter*. Early results indicate that *Salmonella* incidences have decreased since implementation of performance standards. FSIS's stand will likely be that *Campylobacter* reductions are necessary and possible, and that regulatory standards will achieve this goal quicker.

Recent industry data verify the effectiveness of immersion chilling of poultry in reducing overall microbial levels on poultry carcasses, specifically *Salmonella* and *Campylobacter*. The effectiveness of immersion chilling and other interventions in reducing foodborne pathogen levels may also further hasten FSIS to establish *Campylobacter* performance standards. Consumer pressures on FSIS continue to influence regulatory actions. The prevalence of *Campylobacter* on poultry carcasses promotes the assumption that those levels are the prime causes of Campylobacteriosis in humans, yet this cause and affect has not yet been clearly shown by incidence data, a situation which must be cleared before further regulatory action is taken.

Key Words: *Campylobacter*, Food Safety, Regulatory, Chilling

14 *Campylobacter* as a Foodborne Pathogen.

A. L. Waldroup*, .

Campylobacter is considered the leading cause of bacterial foodborne illness, causing severe diarrhea (1/3 of patients have bloody diarrhea), cramping, abdominal pain, fever, and vomiting. The CDC estimates that *Campylobacter* is responsible for 2-8 million infections and close to 500 deaths each year. *Campylobacter* enteritis is most common in children under 5 yr and especially under the age of two. Less than 1% of the cases of diarrhea caused by *Campylobacter* are bacteremic. The bacteria can trigger Guillian-Barre syndrome (GBS), a rare paralysis - inducing disease. Data suggests that up to 40% of the 5,000 annual cases of GBS may be triggered by *Campylobacter*. Antibiotic treatment for *Campylobacter* infection is usually recommended for pregnant women and patients with severe illness or weakened immune systems. Common sources of *Campylobacter* include raw poultry, unpasteurized milk, contaminated water, and feces of infected cats or dogs. The most common causative factors involving poultry include cross contamination and lack of proper handwashing. Many cases occur when individuals eat or smoke during preparation of raw poultry, fail to wash their hands after handling raw poultry, or contaminate food contact surfaces with juice from raw poultry. Unlike *Salmonella*, *Campylobacter* is usually present on raw chicken in levels sufficient to cause illness without temperature abuse. In some cases the infective dose may be as low as 500 organisms, which could be present in one drop of chicken juice.

Key Words: Campylobacter Symposium, Foodborne Illness, Poultry

15 Origin and Relationship of *Campylobacter* and *Salmonella* Contamination of Poultry During Processing.

J. A. Byrd*[1], [1]*USDA-ARS Food Animal Protection Research Laboratory, College Station, TX.*

Campylobacter and *Salmonella* are leading causes of human foodborne illness. Effective intervention strategies require an understanding of the origin of these pathogens and cross contamination of carcasses during processing. Clearly, effective programs must involve multiple intervention strategies at critical control points from the farm-to-table for control of these pathogens. Contamination of the broiler carcass, when present, irrefutably begins on farms, with potential cross-contamination of non-contaminated carcasses at some points during processing. Mandatory pre-harvest feed withdrawal has been shown to markedly and significantly increase the incidence of *Campylobacter* and *Salmonella* in the crops of market age broilers. A 2- to 3-fold increase in *Campylobacter* incidence has been observed after 5 hour or greater feed withdrawal, most likely due to ingestion of contaminated litter and feces. Increased carcass contamination has been observed during the transport and holding of live poultry prior to entering the processing plant, and may continue during processing. Although carcasses exiting the scald tank typically have reduced numbers of *Campylobacter* and *Salmonella*, contamination of broiler carcasses has been shown to increase during feather and viscera (including crop) removal. During evisceration, several sites of possible *Campylobacter* and/or *Salmonella* contamination must be addressed. The selection of different styles or types of processing equipment may increase the incidence of *Campylobacter* carcass contamination. The identification of critical control points will allow the selection of intervention strategies to help reduce the number of pathogenic contaminated carcasses. These steps must be a total integrated farm-to-table strategy that must begin before the animals are placed on the farm (breeders and hatcheries) and must continue through handling and preparation by the consumer.

Key Words: *Campylobacter*, Processing

16 Methods for Detection, Isolation and Identification of *Campylobacter*.

O. A. Oyarzabal*, *Novus International, Inc., St. Louis, MO.*

Conventional isolation procedures for identification of *Campylobacter*-like bacteria from ready-to-cook poultry include: a) enrichment of the samples in selective broths (Hunt and Radle or Bolton) at 37-42°C for 8-12 h; b) streaking enriched samples onto selective plates (campy-cefex or charcol cefoperazone deoxycholate agar) that are incubated at 37-42°C for 24-48 h; c) determination of presumptive *Campylobacter* colonies under dark field or phase contrast microscopy; and d) biochemical screening of thermotolerant isolates (*C. jejuni*, *C. coli* and *C. lari*) with hippurate and antibiotic resistance/sensitivity tests for species identification. The isolation scheme is done under microaerophilia and takes from 2 to 4 days. The most frequent species isolated are *C. jejuni* and *C. coli*. Since *Arcobacter* spp. can also be isolated with this procedure, lengthy testing of isolates for growth under different atmospheric conditions may be needed to differentiate between *Arcobacter* and *Campylobacter*. To circumvent the limitations of conventional microbiology methods for *Campylobacter* identification, DNA techniques, such as the polymerase chain reaction, are now being incorporated into the food microbiology laboratory. Several PCR assays are available for the identification of *Campylobacter* and are based on the amplification of the flagellin gene, the 23S rDNA, the 16S rDNA, housekeeping genes, or random segments of the genome. All these protocols are useful for genus identification and some even for species confirmation. Due to new sequencing findings at the Sanger Centre, Cambridge, U.K., the genomic map of a reference strain of *Campylobacter jejuni* has been recently revised. This information may be used to develop new species-specific DNA-based identification assays that will