**NE-1942 Annual Meeting:**

**Enhancing Poultry Production Systems through Emerging Technologies and Husbandry Practices**

Friday, July 23, 2021

**Virtual Meeting**

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The meeting was called to order by Brett Ramirez at 1:00 pm.

**Introduction of Participants:**

* Pratima Adhikari – Miss State – Laying hen nutrition, management, gut health
* Mary Anne Amalaradjou – U Conn – Food safety, natural antimicrobials
* Ken Anderson – NC State – Laying hens, eggs
* Scott Beyer – Kansas State – Poultry nutrition and management
* John Boney – Penn State – Broiler, turkey nutrition and management
* Dianna Bourassa – Auburn – Processing food safety and welfare
* Lilong Chai – UGA – Extension engineer
* Chongxiao (Sean) Chen – NC State – Turkey health
* Aditya Dutta – U Del - Physiology
* Greg Fraley – Perdue - Ducks, layers, and broilers, neurobiology of welfare and repro
* Richard Gates – Iowa State - Layers
* Rajesh Jha – U Hawaii - Poultry nutrition and gut health
* Anup Johny – U Minnesota – Food safety
* David Kelleghan – Iowa State – Engineering, ammonia emissions
* Aaron Kiess– NC State – Egg Layers, Food Safety
* Ken Koelkebeck U of Illinois –Laying hens, broilers extension, heat stress, management
* Dawn Koltes – Iowa State - Physiology
* Hong Li – U Del – Welfare, housing systems
* Lingjuan Li – NC State – Environmental control, ag engineering
* Yi Liang – U Ark – Ag Engineering
* Birendra Mishra – U Hawaii – Reproductive health
* Wilmer Pacheco – Auburn – Feed milling
* Paul Patterson – Penn State – Laying hens, nutrition, nutrient management
* Shelia Purdum – U Nebraska - Nutrition
* Brett Ramirez – Iowa State – Engineering, poultry housing, ventilation
* Prafulla Regmi – UGA - Welfare
* Harsha Thippareddi – UGA – Food safety
* Indu Upadhyaya – U Conn – Food Safety Ext Spec
* Kumar Venkitanarayanan – Advisor - U Conn – Food safety
* Lin Walker – NC State – Food safety
* Kelley Wamsley - Miss State – Broiler nutrition, feed particle, amino acids
* Yang Zhao – U Tenn – Engineering and management
* Frank Siewerdt – USDA NIFA

**Academic Advisor Update**

Kumar Venkitanarayanan (Associate Dean Research in College of Agriculture, Health and Natural Resources, U Conn) serves as the project administrator. The NE-1942 Multistate Project is highly productive project with many grants, publications, and collaborations.

**NIFA Representative Update**

Frank Siewerdt is the USDA-NIFA National Program Leader for the Division of Animal System.

The update notes were also provided in pdf format.

I. News and Personnel Updates (<https://nifa.usda.gov/newsroom>)

A. NIFA relocated to Kansas City on September 30, 2019 and lost about 75% of its staff. NIFA now has ~225 employees and all mission critical functions have continued.

B. On Jan 4, 2021 Dr. Carrie Castille was appointed as the NIFA Director.

C. Dr. Deb Hamernik joined NIFA in July 2020 as Director, Division of Animal Systems and was appointed Deputy Director, Institute of Food Production and Sustainability in November 2020. She previously served as Associate Vice Chancellor for Research (2018-2020) and Associate Dean, Ag Research at the University of Nebraska-Lincoln (2009-2018) and National Program Leader with USDA CSREES (1997-2009).

D. National Program Leader News:

* Dr. Amrit Bart (Aquaculture and International Programs) was on sabbatical leave from the University of Georgia since January 2020. Dr. Bart’s appointment with NIFA ends on July 23, 2021.
* Dr. Timothy Sullivan (Animal Health and Aquaculture) Tim joined NIFA in June 2020 from the Gloucester Marine Genomics Institute where his specialty was Animal Health and Aquaculture.
* Dr. Frank Siewerdt (Animal Genetics, Genomics and Welfare) Frank joined NIFA in October 2020 after 12 years in the poultry industry, the last 5 as senior director of genetics at Cobb-Vantress. Frank also held positions at the University of Maryland and at the FAO.
* Dr. Kathe Bjork (Animal Health and Antimicrobial Resistance) Kathe joined NIFA in November 2020 from APHIS as a veterinary medical officer (2008-2020) and antimicrobial resistance specialist (2015-2020).
* Dr. Andres Cibils (Rangeland Ecology and Grazing Management) joined NIFA in February 2021 after 17 years at New Mexico State University where he was Professor of Rangeland Science in the Department of Animal and Range Sciences.
* Dr. Angelica Van Goor (TBD) joined NIFA on July 2021 after a postdoctoral appointment with the ARS in Beltsville, MD.

E. New Program Specialists:

* Terry Radke joined NIFA in April 2020. Terry has a M.S. in Animal Science from the University of Nebraska-Lincoln and has more than 20 years of experience in the animal nutrition industry.
* Cierrah Kassetas joined NIFA in November 2020. Cierrah has a B.S. in Animal Science from New Mexico State University and an M.S. in Animal Science from North Dakota State University.
* Danielle Farley joined NIFA in November 2020. Danielle has an M.A. in Communication Studies focused on Risk and Crisis Communication and Knowledge Management from the University of Montana.
* Beth Krehbiel joined NIFA in December 2020. Beth has a B.S. in Agriculture from Kansas State University and an M.S. in Animal Science from Colorado State University.
* Rekia Salter joined NIFA in January 2021. Rekia has a B.S. in Animal Science from Tuskegee University and an M.S. in Dairy Science from the University of Wisconsin.

II. NIFA Budget

Congress passed the FY 2021 Omnibus Appropriations Bill that provided a ~3.5% increase in funding for NIFA compared to FY 2020. NIFA’s comparative budget table will be posted at <https://nifa.usda.gov/budget>.

III. Competitive Programs

1. Three AFRI Requests for Applications (RFAs) have been or will be released for FY 2021 and FY 2022. See <https://nifa.usda.gov/afri-request-applications>.

1. Sustainable Agricultural Systems (RFA for FY 2021)

2. Education and Workforce Development (RFA for FY 2021-2022). Includes pre- and postdoctoral fellowships, undergraduate experiential learning, and K- 14 educational programs.

3. Foundational and Applied Sciences (RFA for FY 2021-2022)

a. Animal Health and Production and Animal Products. Next application submission deadline is May 6, 2021.

b. Crosscutting Programs

Critical Agricultural Research and Extension (CARE)

Data Science for Food and Agricultural System (DSFAS)

Inter-Disciplinary Engagement in Animal Systems (IDEAS)

Tactical Sciences for Agricultural Biosecurity

c. Agricultural Innovation through Gene Editing has been sunset

B. Other competitive grant programs with opportunities for animal science research, extension and/or education

1. Organic Agriculture Research and Extension Initiative (OREI); Organic Transitions

2. Beginning Farmers and Ranchers Program

3. Biotechnology Risk Assessment Grants (BRAG)

4. Special Research Grants Program - Aquaculture Research

5. Small Business Innovation Research (SBIR); 8.3 Animal Production & Protection; 8.7 Aquaculture

6. AFRI Small and Medium-Sized Farms (see Ag Economics & Rural Communities in AFRI Foundational RFA)

7. AFRI Engineering Products and Processes (see Ag Systems & Technology in AFRI Foundational RFA)

C. Interagency Funding Opportunities

1. Ecology and Evolution of Infectious Disease – NIFA partners with the National Science Foundation (NSF), NIH and the U.K. Biotechnology and Biological Sciences Research Council. Applications are submitted to and reviewed at NSF with NIFA, NIH & U.K. participation. NIFA plans to invest $5 million in FY2021.

2. A strategic planning workshop titled “Future of Biomedical and Agricultural Research Programs Using Large Animals” was hosted by Michigan State University and the University of Missouri on May 28 and 29, 2019 on the NIH campus. A workshop summary will be available soon.

D. Program outcomes for AFRI Foundational Programs in FY 2020.

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IV. Contact Information for the Division of Animal Systems

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Q&A

* Food Safety is in a separate Priority area from Animal programs. These programs can be found with a search of the NIFA website. Dr. Mark Carter is the contact.
* IDEAS is a good place for crosscutting emissions and EPA collaborative work. IDEAS is multidisciplinary with multiple solutions to problems or solving multiple problems with a potential budget of $1M per project. IDEAS is integrated project type of research and extension or education. <https://nifa.usda.gov/sites/default/files/rfa/FY-2021-2022-AFRI-Foundational-and-Applied-Science-RFA-Final-07172020.pdf>
* Frank is looking forward to participating in our meeting each year. He also suggested that we also consider SAS grants with a $10M project budget.

**Administrative Updates**

Adoption of 2020 Minutes

Ken Anderson, moved to approve the minutes of the 2020 annual meeting that was held in virtually. This was seconded by Paul Patterson. The minutes were approved by unanimous vote.

Election of New Officers

John Boney will be the Sr. Executive for 2022.

Pratima Adhikari was nominated for Jr. Executive for 2021 by Kelley Wamsley.

Indu Upadhyaya was nominated for Jr. Executive for 2021 by Anup Johny.

Following a zoom poll, Pratima Adhikari was elected (11/19 votes) by 55%.

Anup Johny suggested that we elect two Jr. Executives in order to accommodate the large group. Brett Ramirez will ask Kumar about the content of our bylaws.

Dianna Bourassa called for volunteers for the secretary position.

Indu Upadhyaya was nominated as secretary by Rajesh Jha. Ken Anderson moved to close nominations. Ken Anderson moved to elect by acclimation.

Indu Upadhyaya will serve as secretary starting 2021.

2022 Meeting Location and Mid-year Meeting

The mid-year meeting will be held in conjunction with IPPE in January. Dianna Bourassa will get the information from Ken Anderson and handle the room reservation.

Although Hawaii was suggested as a location for the annual meeting, this location was tabled because of the recent multistate meeting held in 2019 and a lack of ability to visit facilities due to biosecurity.

Alternate options were suggested including having the meeting in conjunction with the Poultry Science Association meeting in San Antonio July 11-14, 2022, Iowa State, Savannah GA, Wilmington NC, Paris in conjunction with Worlds Poultry Congress, Brazil in conjunction with the PSA Latin American meeting.

A zoom poll was conducted to vote between international locations Paris (WPC meeting) and Brazil (PSA Latin American meeting). Brazil was chosen with a 12/23 (52%) vote.

As an alternative, four locations were voted on for a domestic location including Iowa State, San Antonio, Savannah, and Miss State. Savannah was voted as the alternative location with 17/23 votes (74%). If the alternative location of Savannah is utilized, Pratima recommended that the meeting be conducted in summer, prior to the start of the academic year. Ken Anderson seconded.

If the meeting is held in Brazil in conjunction with the PSA Latin American meeting, we will look into submitting a proposal for a NE-1942 participant symposium. Frank Siewerdt will be glad to provide contact information for us to coordinate facility visits as part of our meeting and may be able to travel with the group. Wilmer Pacheco suggested several locations in Brazil that would be useful for the group to visit where we could fly in for the PSA Latin meeting, travel to different poultry locations, then return to the US from a different airport.

Other Administrative Items

Ken Koelkebeck will need 1 to 2 paragraph station reports plus publications and how they align with the two objectives of the multistate. The word document is due to Ken Koelkebeck by September 13, 2021. Publications should be in Poultry Science format. Instructions for station reports were sent to the NIMSS participant list by Brett Ramirez on July 20, 2021. Associate Deans for Research in colleges should assist with signing up for the NE-1942 project in NIMSS.

**Station Reports**

University of Arkansas

Yi Liang reporting. On the applied research side, fabric based solar collectors were tested on a commercial broiler house at the commercial broiler research facilities on preheating for brooding. During a Fall flock placed in October and a Winter flock placed in January, the temperature difference at the inlets and outside as well as the air flow through the solar collectors was recorded and the energy delivered by the solar collectors was calculated. The collectors are about 20 m2 each and there were six on each house roof. An adjacent house was used as a control for energy saving comparison. Energy delivery due to the solar collection was calculated. The collectors were operated under two different modes; 1) when additional air inlets were used besides the traditional side wall inlets when the minimum ventilation fans were operating during brooding and 2) when the solar collector was used as heaters when the temperature in the collector was higher than the target temperature at the time during brooding. Gas meter readings were collected daily for energy consumption data from the treatment house and control. Results from the energy calculation showed approximately 7% energy savings from the treatment house with the collector. However, the meter reading from the fall flock showed about 6 to 7% gas savings, which matched with the calculated energy savings. The winter flock meter reading showed an equivalent amount of gas consumption. There was a slight energy savings, but the the configuration of the current installation prevented longer usage of the collectors over the winter daytime period. This shorter period could have resulted in less than anticipated energy savings. When using solar to heat a broader house without any storage components, the solar is only going to provide supply during the daytime. Because energy consumption is higher during nighttime this is a fundamental downside of this kind of design.

Auburn

Dianna Bourassa reporting. We have been working on the influence of dust on the transmission of *Salmonella* in broiler houses. Amrit Pal recently defended his MS evaluating poultry litter *Salmonella* levels required for transfer to associated dust, evaluating the presence of *Salmonella* in settled dust, and transmission to chicks through aerosolized *Salmonella*. *Salmonella* was nebulized for chick infection and transmission was evaluated in internal organs. This work has resulted in one published, one submitted, and one manuscript in preparation. In addition, antimicrobial interventions during first processing were evaluated including acidified PAA and sodium bisulfate. Other current work includes the assessment of water quality on antimicrobial efficacy. Ken Macklin has been working on evaluating *Salmonella* transmission in litter and the influence of a variety of litter treatments.

Wilmer Pacheco reporting. In collaboration with Ken Macklin a project tracking *Salmonella*, *E. coli*, and clostridia in feed ingredientsthrough a mixing, pelleting, cooling, and load out. The effect of prevalence and reduction of microbial loads were evaluated. Finishing feed was evaluated for any cross contamination after pelleting. A student is working in a new methodology to quantify the particle size inside pellets. The poultry industry has been focused on particle size of corn but it is known that when we mix corn with other ingredients the particle size of the mash is different. Depending on how feed is pelleted, there is a lot of grinding in the pellet, so the idea is to be able to quantify you know how much grinding is in the pellet mill and then creating this methodology can help us to target better the particle size requirements in broilers. Another student is working on a project with the US Grain Council getting corn from Argentina and Colombia. We are looking how the origin of corn affects the performance of the chicks. We are also quantifying AME for each corn and amino acid digestibility. Another student is working looking at interactions between a phytase and alpha galactosidase. We are evaluating the effect of adding both enzymes as well as the different levels of those enzymes as well as phosphorus release and energy release in those diets.

University of Georgia

Harsha Thippareddi reporting. His lab has mostly focused on peroxyacetic acid and it's use in processing. One project is looking at automated to traditional peroxyacetic acid. PAA is normally produced in a central location and shipped as a concentrated solution or 22 to 24% peroxyacetic acid along with the acetic acid and hydrogen peroxide in equilibrium, but there have been some issues related to OSHA personnel safety in terms of storage and transportation. An alternative solution using an on-site generated was looked at evaluating the efficacy of on site generated peroxyacetic acid at equivalent concentrations of regular or conventional PAA at two different pH levels (8.5 and 10). There was not much difference between the two. The pH of PAA is 4 to 5 but a pH of 8.5 or higher is preferred because of the yield. However, like with chlorine, the pKa is around 8.5 so any higher than that it will be in a dissociated form. Efficacy of peroxyacetic acid adjusted to higher pH values was evaluated from pH of 8.5 and 10.5. There was no drop in the efficacy in terms of *Salmonella* or *Campylobacter* reductions. In continuation of the same project, antimicrobial interventions throughout the process including pre chill dip, post-pick dip, post-chill dip, and parts dip with PAA were evaluated for individual interventions and total additive reductions. There were not any attitude reductions with a maximum of around 2 log reductions regardless of how many times the microbial intervention was used. This data was presented at IAFP.

Lilong Chai reporting. Air quality management in cage free house sponsored by Ag industry center. The project is for testing the effect of different bedding material on ammonia and airborne bacteria. A camera is used to monitor the behaviors of laying hens to make sure the birds like the new bedding material. An electrostatic charging system was purchased from Minnesota. Another project is precision poultry farming. A monitoring system is used for tracking the birds feeding, drinking, and resting behaviors as well as distribution in different zones of the house. Students are coding and there is currently some preliminary data. They can do real time monitoring how many birds are located in the feeding zone and how many birds in the drinking zone and how many birds are in the resting zone. That data will be used to evaluate gait score and other welfare indicators. Several articles have been published.

University of Hawaii

Rajesh Jha reporting. The Hawaii team of Rajesh, Birendra and two other faculty work together on poultry projects. They could not do a lot of trials in the past year due to the pandemic, so they focused on publications. Rajesh is working on multi-species nutrition, but increasingly broiler nutrition. He is working on alternative feedstocks evaluation their nutritional and functional values. It is more focused on utilization and their effects on gut health from a holistic approach, and not as an immunologist or microbiologist. He has been testing the individual monomers of non-starch polysaccharides looking at different polymer units of oligosaccharides with not just two or three different chains and how those impact on the gut health function. He has been using in vivo fermentation models typically used in pigs which he has now adopted in poultry. Using all three models gives flexibility to do more with limited resources. Rajesh is working with farmers of a range of sizes for getting good value in markets and general poultry production. He is still working with human gut health evaluating fruits. With international collaborations he has continued working with the lab in China and Korea with a sponsor working there virtually this year.

Birendra Mishra reporting. Birendra has been working to improve the reproductive efficiency of laying hens in understanding the ovulatory process and how eggs get assembled inside the oviduct. He has identified several novel genes and the pathways involved in egg production or formation in the oviduct and also the ovulatory process. He is working on understanding how oviposition and ovulation are linked which is very crucial for increasing the egg production. He has published a couple papers on this area. His other area of research is the effect of environmental heat stress on broilers and laying hens. He is trying to mitigate stress by supplementing antioxidants and polyphenols compounds and understand the effects on the growth performances or gene expression metabolomics and microbial profiles. So far, he has been successful in mitigating heat stress by supplementing the polyphenol compounds. He is also testing more compounds in these areas. He is looking forward to any collaboration especially since Hawaii does not have turkeys, ducks, and other species. He will be happy to collaborate on reproduction on molecular biology including transcriptomics and other omics.

Iowa State

Richard Gates reporting. Richard is the director of the Egg Industry Center which is separate from Iowa State. The Egg Industry Center has a small research fund each year. The call for proposals will be in November and are typically up to $200,000 in total. These are not big projects, but they are very focused. The topics cover the whole egg industry range except for human nutrition impacts of eggs. The board of directors (industry people) decide what to fund. Rich makes sure the science is there behind the proposals. He encourages everyone working on anything related to egg production to apply. Eight states so far have passed cage free legislation. Rich works to help the egg industry figure out this potential transition to cage free egg production. The industry is on track to fall short. Approximately 66% of all facilities would need to be cage free by 2026 to meet all of the retail pledges in all of the state laws. In order for it to happen, an investment of about 8 1/2 billion dollars in new facilities is needed. This is creating all sorts of challenges for the industry but also some opportunities for applied research including how to better control particulate matter. On the topic of sustainability, he has just launched a survey of all egg producers in the country to determine a new benchmark. About 10 years ago a 50-year study was done to compare egg production in 1960 with 2010 and showing incredible improvements in welfare, efficiency, and productivity that caged conventional cage production systems created. With the industry shift in the last 10 years he is trying to capture a new baseline with assistance from the United Egg Producers. Chad Gregory is executive director and he has a goal of getting responses from at least 200 million birds worth of companies in the next few weeks. We with then do a life cycle assessment and feed into both US round table for sustainable poultry and eggs, into the UEP, and the American Egg Board sustainability efforts. If they are funded by NIFA, there is a $10 million SAS proposal under review on the sustainability of US egg production.

Dawn Koltes reporting. She is focusing on host microbe interactions and intestinal health and well-being of laying hens and, in the near future, turkeys. Dawn has been working on the design of a new turkey facility at Iowa State University. She would like to get into more sensor work and some other areas that are not strictly Physiology. Dawn will be evaluating intestinal permeability utilizing sensors and other environmental factors.

Brett Ramirez reporting. With more cage-free facilities in Iowa, leakage or infiltrations are big issues when trying to maintain sufficient ventilation and well distributed ventilation in winter. Some facilities are getting upwards of 100 feet wide by 300 to 600 feet long. With such a large room there are a lot of leaks. He is working towards quantifying that infiltration rate to help guide future construction practices. Brett is developing new approaches for manure belt drying in the different style housings to help during producers avoid peak demand charges. Using a survey across Iowa he was able to see what kind of rates people are paying and what kind of demand charges they are getting. Some of these producers are paying large amounts for electricity, especially in the middle of summer with everything running. He is also working on creating a standardized procedure for eventually assessing PM reduction in cage free housing.

David Kelleghan reporting. David is a researcher based in Ireland currently in Ames for three months for a Fulbright scholarship working with Rich and Brett on ammonia emissions. He has work in Ireland on emissions from layers and has also done work on ecological impacts from ammonia looking from the ecological perspective but also monitoring emissions and modeling dispersion into the atmosphere.

Illinois

Ken Koelkebeck reporting. Carl Parsons still doing nutrient experiments and bioavailability of feed ingredient at the research farm. Illinois has a new building with environmental chambers.

Purdue

Greg Farley reporting. Greg, Darren, and Marissa are working with engineers on developing new technology of individual ID and tracking of birds in a cage free hen houses and duck barns that includes environmental sensors to determine how birds are interacting with their resources and where they are spending their time across the day. Ultimately this is to track all of the birds in the house. They are also working with a startup company that has developed a new technology of LED lighting systems (pulse alternating wavelength system). He is working with ducks and layers to validate the welfare implications. Greg is doing multiple different behavioral, neuroendocrine, and other physiological measures to ascertain the stress and welfare under these lighting systems. Lighting greatly influences laying hens to increase the time to first lay, increasing the size of eggs or percentage of large and extra large eggs, and calming the birds. Another series of projects and in Greg’s lab is to develop some noninvasive measures of welfare and better understanding the birds themselves. In last few years it has become clear that we don't know as much as we think we do about the hypothalamic, adrenal, pituitary axis and the physiological ramifications of glucose corticoids. His lab is reassessing this and one thing that has come out is that cortisol is an important player, not just corticosterone. In another project Greg and Darren teamed up with a wildlife physiological ecologist to develop mathematical models of bird vision under different lighting systems. Under the typical LEDs that are in cage free layer houses, if the perches and ramps are made of galvanized metal, the birds can't see them, which helps to explain some of the broken keels. Greg is also working with another ecological physiologist to better understand all of the different vocalizations ducks make. He has learned that ducks have 13 distinctly different vocalizations. They are trying to understand the behaviors associated with each of these vocalizations in order to understand what is going on inside the barn.

Minnesota

Anup Johny reporting. Minnesota has three poultry faculty members, one in food safety, one in nutrition, and one in reproductive physiology. There are five doctoral students, one masters student, and 7 to 10 undergraduate students working on various poultry projects. Sally Noll’s is continuing to examine a food pad dermatitis scoring system for turkeys as related to welfare conditions. A new histological scoring system was developed to assess the footpad condition and its relationship to external scoring. On an individual basis external scores generally reflected histological changes. Inflammation was proportional with the injury, however turkeys did not exhibit chronic inflammation, which would be associated with an ongoing pain. Within a moderate severity on farm score category, a mix of histological characteristics was observed confirming that a moderate to mild external score represents a changing flock situation that should alert the producer to evaluate environmental flock conditions and resulting changes that are needed. Anup’s research explores the potential of strain level probiotics, essential oils, and vaccination strategies against *Salmonella* in turkeys and broilers. He previously reported that dairy originate probiotic bacteria resisted cecal colonization of drug resistant *Salmonella* Heidelberg in poults and growing turkeys. The continuation of the research in adults and 12 week old turkeys was published in Poultry Science. He recently reported that probiotic bacteria will reduce the cecal colonization of *Salmonella* Heidelberg by more than two log cfu per gram in the cecum and reduced the pathogen dissemination to internal organs in turkeys. In another project he is investigating the effects of a probiotic strain on the cecal microbiota of two week old poults, seven week old turkeys, and 12 week old adult turkeys. Using MiSeq results indicated that the richness and the abundance of microbes were similar among the treatment groups however the treatments cost parent class string of the samples among each other indicative of the treatment effects. Drug resistant *Salmonella* challenge resulted in modulation of specific microflora in the *Salmonella* groups associated with inflammatory responses in turkeys and the supplementations probiotic strain increase relative abundance of carbohydrate fermenters and short chain fatty acid produced in general in the probiotic group. He also published on the GRAS status lemongrass essential oil against drug resistant *Salmonella* Heidelberg attachment to skin and meat. He observed that Heidelberg populations were decreased in poultry cecal contents with lemongrass essential oil. Anup also observed complete inhibition of motility biofilm formation and activation of preformed biofilms with lemongrass on skin. Lemongrass significantly reduced Heidelberg in soft scalding conditions and chilling conditions. His group members are three doctoral students, a research associate, and six undergraduate students. Dr. Gannon, the new reproductive physiologist, is working on projects with the doctoral student, a research associate, and two undergraduate students.

Mississippi State

Kelley Wamsley reporting. Kelley has been continuing on doing work with the Cobb MV by Cobb 500 looking at the finisher phase and looking at AME by amino acid interactions and trying to optimize what the formulation should be. She is also doing some digestible lysine requirement work with that bird. She just finished the last project within this time period looking at the finisher phase. She has been doing some isoleucine requirement work with the Ross 708 broiler. They have completed the finisher phase work and have published the starter paper published as well as a couple other lysine papers published with the Cobb MV. Kelley just finished doing a project looking at the preference of the Ross 708 in the starter phase for overall feed particle size to determine the optimal feed particle size is in terms of either crumble or pellets and linking that with bird beak capacity. She is looking at a carryover effect in the grower and finisher phases which they are analyzing now.

Pratima Adhikari reporting. Pratima is planning to work with layers. Last year she did a study with LED lighting system in a floor pen pullet and then tested through production in the laying hand phase. They looked into two different light colors, blue during the pullet phase and red during the laying phase when the birds first started laying. She evaluated production, hormonal profiles, stress hormones, and tonic immobility testing. The manuscript is under review and one abstract was presented in IPSF 2021. Another study funded by US Poultry & Egg was completed last December on the role of feeding a commercial protease enzyme and how it effects egg size and production. Two manuscripts are under preparation and two abstract has been presented in two different meetings, IPSF and PSA. Pratima will be looking into the disease aspect of *Salmonella* and *E. coli* and try to form a model in their BSL2 facility. Some preliminary work was done with *Salmonella* Enteritidis in laying hens. The main objective of the study is to looking into different interventions against Enteritidis using vaccinated or unvaccinated flocks raised and vaccinated at Mississippi State. She is also looking at avian pathogenic *E. coli* in laying hens and colibacillosis cases versus a healthy flock that may have these pathogenic strains. They are screening isolates and will use a challenge model in the future. Another US Poultry and

Egg funded project will be to evaluate limestone particle size ratio and commercial phytase interactions on the digestibility of calcium and phosphorus. With funding from the Almond Board of California she will test almond hull enzymes fed to layers.

North Carolina State University

Ken Anderson reporting. NCState is putting in a small aviary system with four rooms and adding a 54 replicate cage facility that will handle either broiler breeders or layers. In Piedmonte they are putting in a 24 replicate aviary system that will mimic both the US and the European model. Half of the replicates will have access to the outdoors and range. They estimate a cost of 1.1 million with the remodel bringing costs down. NCState will be hiring a variety of new faculty. Ramone Mirros accepted as a reproductive physiologist. Aaron Kiess will be doing layer research. There is a turkey research position opening soon and a processing position currently open. Ken has been looking at the use of essential oils both in cage production as well as in free range situations. On the last OIE survey, 90% of all the laying hens in the world are still kept in cages although this may be changing with Australia's efforts. They have been looking at essential oils and geo grids in range and their influence on production, forage intake, and prevention of internal parasites, heterakis, roundworms, and tapeworms. They are looking at ways to monitor internal parasite populations without necropsy and looking at the internal parasites. They are also looking at the behavior of birds on range with Prafulla Regmi, who is now at UGA. He has a graduate student collaborating with the USDA ARS on alternative feed ingredients that are very prevalent in North Carolina, sweet potatoes and high oleic oil peanuts. Ken is working on a national survey on red mite populations as well as other insects that happened to wander into the traps with Amy Merlot at UC Davis obtaining information in the different regions of the United States. Another project is looking at the uptake of omega-3 and the influence on gut health and muscle metabolism. He is also working on a project coordinated by a PhD student related to work done at Kansas State 30 some years ago by Jim Craig looking at hen density in large capacity colony cages, which are becoming more prevalent in the industry. They are looking at stress behavior, productivity, and quality. Ken is still involved with mass depopulation research which has been challenging dealing with the animal rights groups. They are looking further into validating enhancing VSD plus added heat to be used in the mass depopulation of the facility. His last PhD student developed a method to monitor the EEGs in birds as they go through the process. Another PhD student is finishing up work comparing a genetic stocks from 1940 with the current commercial stocks. A MS finishing up on heat stress physiology in laying hens. Ken has seven more graduate students coming into the lab.

Lin Walker reporting. Lin is in the stage of developing her own leading project. She is collaborating with Ken Anderson and Jesse Grimes on some of their projects including the density and geo grid study evaluating microbial quality. Lin is working with Jesse Grimes on testing yucca applied to litter can reduce the microbial load of *Salmonella,* *Clostridium perfringens*, and *E. coli*. Lin has a masters student coming this August.

Aaron Kiess reporting. Aaron has been at NCState for about 20 days. His research revolves around looking at antibiotic alternatives and new ways to administer those antibiotic alternatives. He has also looked at processing plant sanitation and how *Salmonella* survives due to biofilm formation or antimicrobial resistance. Aaron has looked at inovo injection as a way to provide probiotics to the egg before chicks hatch to influence the microbiome, which the broiler or layer would have later in life. Soon he will start converting some of his research over into layers at North Carolina State and work with a few of Ken Anderson’s graduate students.

Chongxiao (Sean) Chen reporting. Sean is a new member of this group working with parasitic disease in turkeys. He currently has two projects. The first one is early disease detection in turkeys using histomoniasis disease model and using camera and sensor technology to observe any potential signs during the early stage of disease while trying to understand how a turkey behaves during the disease development. The second project is related to the environmental noise on turkey behavior and performance. In a case from this summer a loud noise led to turkey poults not eating and high mortality. Both projects are currently in progress.

Lingjuan Li reporting. Lingjuan is has two projects, one funded by the NSF doing ammonia emission and monitoring ammonia gas phase and ammonium impact on the soil and the ammonia emission potential for the formation of a secondary PM 2.5. This project at the Piedmont research station was set up a 23 sampling events were collected including 660 air samples and a group of soil samples every six months. Because of the pandemic they ran out of funding and had to recruit a new graduate student. One of the challenges they had was that with low bird densities, air quality was quite good outside, challenging the detection limits. She is going to collaborate with Ohio State University to identify a commercial farm to collect ammonia deposition data for two weeks to strengthen the project. The second project is funded by NIFA evaluating heat stress of heavy broilers over 10 pounds in response to air velocity. She has five heat stress flocks through in the summer of 2017, 2018, and 2019 and are still in the process of analyzing the video data of those stress behaviors response to the air speed. She is also looking at heat and moisture balance to produce a heat moisture production value to update fundamental values for the heavy broiler.

Pennsylvania State

John Boney reporting. John and Paul Patterson have been working together on a soybean meal particle size study looking at energy use starting at the soybean processing facility following that forward looking at pullet hen production, broiler amino acid digestibility, and broiler performance. They found that you can reduce soybean meal particle size down using a 330 seconds inch hammer mill do reduce the true amino acid digestibility of that overall diet. This did not have an effect on pellet production but when fed to broilers they saw a reduction in amino acid digestibility across the board. In a following performance study, John found that when you reduce that amino acid digestibility, birds fed smaller soybean meal particle size did have a reduced performance or worsened FCR. He will follow that up at some point feeding laying hens. John also looked at how this small soybean meal particle size would affect pellet quality and saw an improvement in pellet quality. There is a lot of recent data that would show that as pellet quality improves, performance improves, but that performance bump was not enough to overcome the detriment to amino acid digestibility. Other work in his lab was looking at pellet quality in turkeys. They just finished up a study with tom turkeys out to 19 weeks which was presented at PSA. Overall some nice performance benefits were seen from feeding improved pellet quality. John is starting a project with a county based extension agent looking at lights that have custom recipes where you can pull in whatever wavelength of light or pull out whatever wavelength you would like. They are going to compare a different GAP lighting standards in turkey poults through the brood. Finally John is a part of a group that looking at broiler industry sustainability launching a national broiler survey to gauge where the broiler growers are and how we can target extension programming to them as a lot of these folks are moving towards antibiotic free production.

Paul Patterson reporting. Pennsylvania is the largest producer of organic broilers, turkeys, and layers so there are a lot of birds on the floor exposed to different things. In layers on the floor they are noticing some bedbugs. Paul has been serving industry on this big issue. He developed a bedbug task force and has a survey coming out shortly working with Gregory Martin. Indexing of bed bugs is being done to begin addressing this challenge. Paul works a lot with vegetative buffers. This spring and summer he had a Chesapeake Bay alliance project for water quality with four Purdue farms working to implement buffers for water quality. He has another three farms that have had neighbor issues with dust and odor where he is working with the farmers to put in vegetative buffers. Paul is also working on workforce development on the demand for enhancing the quality of our existing employees and new employees. The industry believes that they don't want entirely four year degree individuals but they are interested in a journeyman poultry person. They are launching an animal sciences apprenticeship program that would be a certified apprentice program with 150 hours of training and 2000 hours on the job finishing with a journeyman certificating poultry practice.

University of Tennessee

Yang Zhao reporting. Yang has three projects, one the smart broiler initiative. In collaboration with the biosystems engineering department at University of Tennessee, he is using a computer vision system to monitor the activity and distribution of the broiler and use this data to develop a model to predict the gait score of the broiler continuously. Yang is going to start a project funded by the US Poultry and Egg Association looking at the growth rate effect on broiler welfare and behavior. The third project is funded by USDA ARS looking at the airborne transmission of bacteria in broiler and laying hen farms. For that project he is in the early stages selecting the best airborne samplers and the most efficient ones to that can be used for the next step, which we will be going to the commercial farm and quantifying the concentration and emission of those airborne bacteria and viruses. Tennessee has 3 faculty in animal science department working on poultry and they are hiring an extension research specialist. They are going to start screening the candidates beginning of August and we hope to bring this person on in September or early October. Tennessee has extension program for cattle but not yet poultry. The biosystems engineering department is leading the effort to develop a poultry extension program and hopefully this program will start in the beginning of next year.

University of Connecticut

Mary Anne Amalaradjou reporting. There are four faculty in the department of animal science working on poultry science. Kumar, the director for this multistate hatch, Indu Upadhyaya, and Abhinav Upadhyay. They are part of one of the SAS projects that was funded last year of which several people in this multi-state or part of looking at sustainable broiler production. It has around 17 institutions involved. Mary Anne is looking at early probiotics supplementation trying to target embryonic growth as a means to improve post hatch performance. She has a student graduated with a manuscript near to submission. She has three other projects including looking at liver, muscle, and intestine function in the embryo as a means to improve hatchability and hatch quality. The other study looking at the evolution of the cecal and gut microbiome in the hatchling and how it translates over time up until market age. The last year she started getting into layers looking at layer production and *Salmonella* control in layers.

Indu Upadhyaya reporting. Indu is also involved in two multistate hatch projects, this group and then then enhancing microbial food safety by risk analysis group. Her work with this hatch project aligns with the second objective. The first project is enhancing the safety of eggs by novel ultrafine bubble technology. The research the equipment has just arrived so experiments are yet to come. Indu is involved primarily with conducting a survey to assess the need of the farmers on safety of the shelled eggs and finding out what are their training needs. Another larger project is the SAS project Mary Anne mentioned. The sustainability of antibiotic restricted poultry production during this summer. Indu has worked with John Boney and Greg Martin from Penn State to develop a broiler survey which will soon be underway. It is a national survey which John and Greg will soon send out to many of the institutions. She has an intern currently working on survey development and extension publication on in feed supplementations of natural antimicrobials to improve the sustainable poultry production. The research part of this project has resulted in two abstracts, one at PSA and one in the conference of research workers and animal diseases. The research was done in Abhinav Upadhyay’s lab and Indu is a coauthor in this work. She will oversee the proteomic section. The results from this research showed that the plant compounds can modulate protein expression of *Salmonella* Enteritidis. A follow up in vivo has been completed. The data is being analyzed and the study will be replicated. Another project that Indu is working on is a USDA seed project developing the evidence-based handling guidelines for improving the safety of free range poultry eggs. It is primarily focused on small scale farmers in New England in collaboration with Becky Sartini from University of Rhode Island. At this point she is contacting layer farms for carrying out a prevalence study to see if *Salmonella* is present or not. She is also surveying their training needs to prepare for providing workshops for small scale producers. Because of visa issues her graduate student has been delayed to Spring 2022. Indu is involved in a lot of Cooperative Extension and a lot of outreach activity with large and small scale poultry farmers. She has also trained the poultry processors in meat and poultry HACCP as a lead trainer providing both virtual and in person trainings with certification, which will then help the poultry processors get a USDA certification. She has also collaborated with the Connecticut Department of Agriculture to organize webinars and to provide more opportunities for meat slaughter and processing in New England. USDA-FSIS was in attendance to offer more counsel to poultry farmers as well on proper poultry slaughter and access to processing facilities. UConn poultry has a big program with 12 to 15 graduate students.

University of Delaware

Hong Li reporting. Hong currently has two directions. The first assessing ammonia control for broiler operations looking at two different types of litter amendments that can be used for ammonia control in organic operations. One is using ?? and acid to control ammonia. The Maryland Department of Agriculture granted a large $5 million project to generate pathogen-free litter and bio char on site by using the poultry litter. Hong has been working with the company to evaluate effectiveness of biochar ammonia control and how the pathogens survive in the litter. Another direction is developing a new vaccination technique for the poultry hatchery potentially improving vaccination efficiency by using a foaming technique.

Aditya Dutta reporting. Aditya just started at UDel. Most of his work primarily deals with layers primarily looking at three different projects. In the first he is doing whole genome sequencing and using computational methods to look at phenotypes rather expression analysis to see what actually drives the selection of certain follicles over others across breeds. The second project is looking at the different reproductive parts in a layer at the single cell level to define the cells that are actually driving the process. The third project is trying to define the microbiome in the reproductive tract following the birds of overtime using ultrasound guided imaging and through biopsies. He is trying to follow them longitudinally and determine how their microbiomes are changing over time. The lab has two graduate students and two undergrads.

**Questions**

Anup Johny for Brett Ramirez. Could you explain standardized testing for litter amendments?

What Brett is trying to do is create a procedure that could be done in the lab so that you can test different mitigation strategies for different litter amendments. They’re using something like a cement mixer with different sampling flow rates to so you can test different types of materials in a way that is somewhat standardized for more systematic testing without having to go into the field at the barn level.

Anup Johny for Ken Anderson – Are you using alternative feed ingredients associated with peanuts?

The North Carolina Peanut Growers Association is looking for uses for peanuts that don't find their way into the human food market. Undersized peanuts are also high in oleic oil, so we have high oleic peanut meal that is being used on a full fat basis for layer diets along with the sweet potato. NC is the number one sweet potato grower in the country.

Greg Fraley for Ken Anderson – Is there any concern about peanut proteins making their way into the bird and being an issue for people with peanut allergies?

That work has been published and virtually none of the material that causes these allergens transfer to the egg.

Harsha for Ken Anderson – What methodology did you use?

They were looking for the detection of the allergen itself in collaboration with USDA ARS. They did they did that part of it but they didn't test on humans. There was no difference in taste test panels. They did look for the allergen in the peanuts that typically cause reactions in humans. Looking at meat is in the process.

Anup Johny for Harsha Thippareddi. How many plants use chlorine?

Most plants have switched to PAA. Some chlorine might be used for sprays but everyone is using PAA.

Mary Anne Amalaradjou for Harsha Thippareddi. Did you sample the wash water?

No, however with PAA will be effective in the presence of organic matter. He was trying to replicate the process starting with 100 ppm PAA for 60 minutes, then 15 seconds at 750 or 1000 ppm for the post-chill dip, and then for the parts step they used around 250 and 500 ppm.

Anup Johny found similar results of 2 log reductions.

Anup Johny for Paul Patterson/John Boney. The certification program is a very good model with 150 hours of training and 2000 hours in job. Is that certificate program already launched?

It is currently in development. The 150 hours is going to be made up of existing extension programs targeted towards the poultry industry. There will be some standalone courses developed for the program. They’re using those existing courses and then the 2000 hours is in line with the US labor folks and in what they require. It is essentially working one year with whatever facet of the industry that they're working with.

The location of the 2022 meeting will be decided at the mid-year meeting at IPPE in Atlanta in January.

Ken Anderson motioned to adjourn the meeting. Seconded by Harsha Thippareddi.

Meeting adjourned at 4:21 pm.