**SAES-422 Multistate Research Activity Accomplishments Report**

**Project/Activity number: NC1180**

**Project /Activity title:** Control of Emerging and Re-emerging Poultry Respiratory Diseases in the United States

**Period Covered:** October 1st to September 30th, 2018

**Date of this report:** December 26, 2018

**Annual meeting date:** October 25th, 2018

**Brief summary of minutes of the annual meeting:**

The annual meeting was held on Thursday, October 25th, 2018, in conjunction with the USAHA annual meeting and the NIFA-PRD-CAP meeting in Kansas City, MO. The venue was the Sheraton Crown Center Hotel.

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| Name | Affiliation | Representing State |
| Mazhar Khan | University of Connecticut (UC) | CT-Rep |
| Chang Won Lee | The Ohio State University (OSU) | OH-Rep |
| David Suarez | South East Poultry Research Lab-USDA | Rep |
| Haroldo Toro  | Auburn University  | AL-Rep |
| Rodrigo Gallardo  | University of California, Davis (UCD)  | CA-Rep |
| Timothy Johnson  | University of Minnesota (UM) | MN-Rep |
| Calvin Keeler  | University of Delaware (UD) | DE-Rep |
| Maricarmen Garcia | University of Georgia (UGA) | GA-Rep |
| Keith Jarosinski | University of Illinois (UI) | IL-Rep |
| Donald Reynolds | University of Nebraska (UN) | NE-Rep |
| Michael Abundo | The Ohio State University (OSU) | OH |
| John Ngunjiri | The Ohio State University (OSU) | OH |
| Mohammed El Gazzar | Iowa State University (IA) | IA |
| Yehia Saif  | The Ohio State University (OSU) | OH |
|  |  |  |

Drs. Johnson and Gallardo opened the meeting with a conference call with the new administrative advisor Dr. Sandra Velleman. During the conference call we discussed specifics on the project re-write and how to write a successful annual report.

After the call lead by Dr. Gallardo, the project re-write strategy was discussed. People in charge of compiling information about the different objectives was assigned and deadlines were set for the work.

Business meeting adjourned 9:15am.

The presentation of annual progress report from each participating station began immediately after the business meeting. All members were actively engaged in the discussions on surveillance, pathogenesis, new diagnostics tools, and vaccine/immunology of various poultry respiratory and immunosuppressive diseases. Research findings and new knowledge were freely communicated among the participating members.

The meeting adjourned at 2:00 pm.

**Accomplishments:**

The accomplished tasks summarized in this report denote extensive collaboration between the NC1180 members. This is particularly true for the collaborative work happening due to the PRD-CAP project funded by USDA/NIFA. In addition, coordination not only inside NC1180 but also with other multistate programs e.g. NE1334 occurs due to the presence of members representing both multistate projects.Fruit of these collaborative efforts are the publications involving members of our project. Those are listed at the end of the report.

**Objective 1. Identify reservoirs of infectious respiratory disease agents in wild birds and poultry.**

-Surveillance activities for AI have been performed (CT). Avian influenza was not detected in poultry, commercial or non-commercial, or exhibition/show bird in Delaware in 2017. From July 2017 to June 2018, 249 samples were collected by the USDA. Currently, we are unaware of the findings (DE).

-Distinct line specific host responses were detected in different poultry breeds in response to NDV challenges.Differential gene expression was detected in resistant and susceptible lines especially in QTL regions (UCD).

-Attempts to characterize the upper respiratory tract virome of chickens demonstrated high influence of the environment in the viral populations detected (UCD).

-Persistence of LPAI and HPAI was investigated in litter used for different cycles. LPAI persisted less than 36 hours after spiking in broiler litter of 1 cycle use, and less than 24 hours in broiler litter used for 11 cycles as well as in both turkey litter groups. Live HPAI persisted less than 72 hours after spiking in all litter groups. In terms of effectiveness of the litter amendment (LA), LPAI did not persist when in sole contact with the LA or in broiler litter treated with it. LPAI persisted less than 8 hours after being spiked in broiler litter alone and less than 12 hours in turkey litter alone or mixed with the LA (**UCD in collaboration with CAHFS**).

-Characterization of the acting *Avibacterium paragallinarum* and testing of the effectiveness of commercial Coryza vaccines in CA was investigated. By molecular methods the acting strains were characterized as a C strain of (*AP).* Vaccines demonstrated to be effective due to the reduction of the bacterial shedding after infection of hens vaccinated twice and challenges with AP(UCD)

-Methods have been developed which can be used to characterize the avian respiratory microbiome (DNA viruses, RNA viruses, bacteria, bacteriophage, yeast/fungi) from tracheal samples (DE).

-Evolution, global spread, and pathogenicity of highly pathogenic avian influenza H5Nx clade

2.3.4.4. (SEPRL)

-Identification of previously unrecognized genetic diversity in avian paramyxovirus serotype 1

(APMV-1) isolated from wild birds in the US (SEPRL).

-Identification of epidemiological risk factors of wild birds (SEPRL).

-Characterization of variant Newcastle disease virus (NDV) from recent outbreaks in countries in

which the disease is endemic (SEPRL).

-Moving pullets vaccinated with CEO ILTV to the hen house, spreading untreated pullet litter and the environment in the pullet houses after multiple CEO vaccination pose a biosecurity risks for newly introduced flocks and neighboring farms (UGA).

-A comprehensive biosecurity program is important to control the spread of several poultry diseases. Special attention and resources should be focused on cleaning (dust and feathers) and disinfection of depopulated farms, as well as proper litter management to avoid indirect transmission of MS to neighboring farms (UGA).

-Studies to simplify the ILTV genotyping has been carried out using single allele MinION sequencing (**UGA in collaboration with SEPRL**)

-The use of comparative genomics to investigate full genomes of attenuated F-strain

vaccine isolates and reference strains of MG was implemented to develop vaccine specific PCR protocols (UGA).

- To better understand the genetic basis for virulence in MS as well as to develop

improved strain differentiating techniques real time PCRs were developed (UGA).

**Objective 2. Develop improved diagnostic capabilities including real time PCR as well as other rapid on-farm tests for economically important respiratory diseases.**

**-** Complete genome sequencing can be used for the analysis of field isolates of ILTV (DE).

**-**Detection of airborne-transmissible highly pathogenic influenza virus during processing of

infected poultry (SEPRL).

**Objective 3. Investigate the pathogenesis and polymicrobial interactions of specific infectious agents associated with poultry respiratory diseases (including interactions with immunosuppressive agents).**

-The association of MHC chicken lines and resistance to IBV genotypes was investigated. This work provided modest evidence for differential resistance to IBV by chickens displaying different MHC haplotypes and insights into the expression of a variety of genes after IBV replication in the host (**UCD in collaboration with NE1334**).

-An ex-vivo methodology of investigating resistance and susceptible chicken lines is in development using tracheal organ cultures (TOC). Methods for eliminating inflammation caused by TOC processing is needed to study the cytokine production in tracheas (**UCD, in collaboration with NE1334**).

-Two MDV encoded viral genes were identified (Glycoprotein C and herpesvirus protein kinase) essential for the transmission of MDV. These genes might be also involved in shedding, attachment and down regulation of the immune response in the host (IL).

-Formulating a diet that is high in digestible protein, contain ingredients that will enhance immune development will provide for the early establishment of an intestinal and respiratory microbiota. We

assessed the potential of immunizing and protecting the bird during this period for various respiratory

pathogens (NE).

**-**Beta glucans enhance the innate andadaptive immune responses through thrombocytes. Researchers propose to prove this hypothesis by using both in vitro and in vivo approaches with avian thrombocytes and chickens (NE).

-Respiratory pathogen studies in chickens with IBDV induced immunosuppression have been performed. Through mixed infection the interactions of IBDV and LPAI infections have been studied (**OH in collaboration with SEPRL**).

-Studies infecting turkeys with SIVs demonstrated the susceptibility of hens to SIVs and human influenza viruses (OH).

-Pathobiology of clade 2.3.4.4 H5Nx high pathogenicity avian influenza virus infections in minor

gallinaceous poultry supports early backyard flock introductions in Western U.S., 2014-2015 (SEPRL).

- Characterization of H9N2 avian influenza viruses from the Middle East demonstrates heterogeneity at amino acid position 226 in the hemagglutinin and potential for transmission to mammals (SEPRL).

-Mallard ducks are a primary reservoir for low pathogenic avian influenza viruses (AIV) in nature

and flock immunity to these viruses influence the AIV subtypes isolated in these birds (SEPRL).

-Pathology and distribution of Velogenic Viscerotropic Newcastle Disease Virus in the

reproductive system of vaccinated and unvaccinated Laying Hens (SEPRL).

-Characterization of the pathogenesis of Newcastle disease viruses in quail (SEPRL).

-The cell mediated immune response of the eye associated lymphoid tissue was studied to identify components and fluctuations of the cell mediated immune response elicited by ILTV after an ocular inoculation with a vaccine and a virulent strain (UGA).

-A tracheal lesion scoring system was studied to evaluate MS infections and co-infections with ILTV (UGA).

-Studies in order to evaluate the effectiveness and degree of protection elicited by HVT+ILTV vaccine was carried out (UGA).

-Ambien ammonia does not inhibit the immune response to IBV vaccination and protection from homologous challenge in broiler chickens (UGA).

- Experiments were carried to determine whether serially administered, live attenuated vaccines against IBV, NDV, and ILTV influence the development and longevity of immunity and protection against challenge in long-lived birds (UGA).

**Objective 4. Develop new prevention and control strategies for poultry respiratory diseases.**

-A recombinant LaSota strain Newcastle disease virus encoding Ark-type IBV S-ectodomain protein (rLS.Se) was generated and used to vaccinate chickens at one and again at 14 days of age. Vaccinated chickens challenged with virulent Ark-type IBV 18 days after the second vaccination exhibited a lower incidence of respiratory signs, a lower viral load in tears five days post challenge and reduced tracheal damage (reduced tracheal mucosal thickness and mononuclear infiltration) than unvaccinated chickens and chickens mock-vaccinated with LaSota not expressing the recombinant protein (**AU in collaboration with USPEA**).

-Enhanced cross protection was demonstrated when IBV vaccination is postponed beyond day 1 of age, most likely due to a strong systemic antibody response a higher IBV specific antibody avidity and more homogenous CD8+T cells (AU).

-The ability of the receptor binding site to bind chicken tissues is influenced by its context (AU).

-Self-adjuvanted SAPN vaccines were generated to be used against avian influenza and IBV (CT).

-Multiple poultry producers continue to successfully utilize a vaccine developed under the regulation 9CFR PART 107.7(b) to control an avian health issue using a homologous genotype IBV variant vaccine that was not available from biologics manufacturers. No adverse reactions have been reported by any company growing chickens in Delaware, Maryland and/or Virginia (DE).

-Current MD vaccines do not spread well. We are improving upon the current vaccines in order to generate vaccines that could be spread and provide protection to the whole flock (IL).

-Different strategies to develop infectious bursal disease virus (IBDV) as a vaccine vector were carried out by using reverse genetics approach (IN).

-Development of the web based “Big Red Biosecurity Program for Poultry” (NE).

- pc4-LAIV can provide good protection in young chickens and prime-boost vaccination with pc4-LAIV and IIV induces a robust protective immune response against heterologous, and partial protection against heterosubtypic HPAI challenges (OH).

-Thermal Inactivation of avian influenza virus in poultry bedding as a method to decontaminate

poultry houses (SEPRL).

-Ten different adjuvants were evaluated for use in vaccines for chickens to protect against highly

pathogenic avian influenza virus (HPAIV) (SEPRL).

-The efficacy of recombinant turkey herpesvirus vaccines targeting the H5 of highly pathogenic

avian influenza virus from the 2014/2015 North American outbreak (SEPRL).

-Short- and long-term protective efficacy against clade 2.3.4.4 H5N2 highly pathogenic avian

influenza virus following prime-boost vaccination in turkeys (SEPRL).

-Protection of commercial turkeys following inactivated or recombinant H5 vaccine application

against the 2015 U.S. H5N2 clade 2.3.4.4 highly pathogenic avian influenza virus (SEPRL).

-Inactivation studies on cells of the immune system of chickens (SEPRL).

-Newcastle disease virus (NDV) has been used as a vector in the development of vaccines and

gene therapy (SEPRL).

**Impacts:**

**Objective 1. Identify reservoirs of infectious respiratory disease agents in wild birds and poultry.**

- Avian influenza subtype H5 and H7 were negative from the LBM and domestic poultry birds in New England states. There is a need to perform virus isolation studies to confirm and identify other subtypes in LBM, domestic and wild birds (CT).

-Identification of genes that are associated with resistance to heat stress and Newcastle

disease virus and can be used to genetic enhancement of disease resistance of chicken in adaption to hot climate. Knowledge of genes associated with enhanced immune response may inform further information on vaccine efficacy in poultry production (**UCD in collaboration with IA, UCD, DE and multistate NE1334**).

-Understanding the virome of the upper respiratory tract might help manipulation of its components reducing infectious disease challenges (**UCD, in collaboration with multistate NE1334**).

-Understanding the persistence and effect of LA will help strategize responses to LP and HPAI events in poultry production (UCD).

-Management focusing on ventilation, better vaccination protocols and reduction of infectious challenges need to exist to avoid these disease outcomes (UCD).

- Methods have been developed which can be used to determine the composition of the

avian respiratory microbiome from tracheal samples (DE).

-This information helps in understanding the evolution of H5Nx HPAI viruses and how they spread by migratory birds (SEPRL).

-The whole-genome sequence of the genotype VI Newcastle disease viruses obtained from

formalin-fixed paraffin-embedded tissues revealed the utility of the technique to track virulent

viruses in the U.S to allow improved epidemiological findings and monitor evolution and genetic

diversity of the virus (SEPRL).

-Because of the proximity with the US, these Mexican regions present a high risk of

introduction through trade, wild birds and illegal transport of birds and are important to the US

poultry industry (SEPRL).

-Understanding the evolution, current spread and methods of detection of these viruses is

important to develop diagnostic reagents that are effective (SEPRL).

- A comprehensive biosecurity program is important to control the spread of several poultry diseases (UGA).

- Surveillance of emerging ILTV strains could greatly benefit from real time amplicon sequencing using the single allele assay and MinION sequencing (**UGA in collaboration with SEPRL**).

- The PCRs developed can be used to detect F-strain vaccine without the time, expense and specialized equipment needed for DNA sequencing (UGA).

- This molecular assay that can differentiate, at a high level, between the M. synoviae live vaccine strain MS-H and field isolates can be used to detect the vaccine without the time, expense and specialized equipment needed for DNA sequencing (UGA).

**Objective 2. Develop improved diagnostic capabilities including real time PCR as well as other rapid on-farm tests for economically important respiratory diseases.**

-Complete genome sequencing can be used for the analysis and characterization of field

isolates of ILTV (DE).

-The detection of AI during processing of infected carcasses can be adaptable to other RNA viruses due to the nonspecific nature of the amplification technique (SEPRL).

**Objective 3. Investigate the pathogenesis and polymicrobial interactions of specific infectious agents associated with poultry respiratory diseases (including interactions with immunosuppressive agents).**

-Knowledge on the association of resistance to IBV and MHC lines can assist the development of new preventative tools that are non-specific

and cross-protective between different IBV genotypes (**UCD in collaboration with NE1334**)

-TOC’s are a good method to use when we need to understand innate immune response in

Tracheas (**UCD in collaboration with NE1334**).

-Identification of MDV genes essential for transmission could have major implications in the design of vaccines that could target MDV spread in a chicken house. Blocking infection and subsequent immune suppression would be highly beneficial (IL).

-Better feed formulation in early stages of chick’s life would provide better responses to respiratory pathogens (NE).

-Based on these data, we conclude that the chicken thrombocytes can be analyzed for their functionalities at a single cell level by flow cytometry (NE).

-Studies will help better define the role of immune suppression on respiratory disease in chickens. The role of IBDV induced immune suppression on these respiratory agents will provide practical information on when and how IBDV should be controlled to prevent respiratory disease in chickens. In addition, information gathered from the 16S rRNA microbiome analysis will be used in devising microbiome modulation-based control strategies for multifactorial respiratory diseases (OH).

-It is important to explore the use of turkeys as a model to study avian influenza interspecies transmission and reverse zoonosis (OH).

-Investigating the pathobiology of AI viruses affecting the U.S. is highly important to understand the epidemiology of the virus and its control (SEPRL).

-It has been demonstrated that low pathogenic AI viruses can mutate to cross species barriers and replicate in mammals. Therefore, the detection and characterization of these low pathogenic AI viruses is critical for identifying emerging strains in poultry with zoonotic potential (SEPRL).

-The study of the role of Mallard ducks in AI infections is crucial to understand the ecology of AI in reservoir species (SEPRL).

-Abnormal eggs and damage in oviduct can be significantly reduced NDV in well vaccinated animals (SEPRL).

-Virulent NDV strains have limited replicative potential and mild to moderate disease-inducing

ability in Japanese quail (SEPRL).

- The identification of cellular immune responses in the eye associated lymphoid tissues that resulted in either virus clearance or virus persistence after ocular ILTV inoculation and provided a first glimpse on the potential relevance that antigen presentation may play in the outcome of cellular immune responses against ILTV. Understanding the mechanism by which antigen presenting cells (APCs) in the eye associated lymphoid tissue are activated and/or inhibited after stimulation with ILTV antigens is necessary for the development of viral vector, subunits vaccines, as well as adjuvants that could effectively trigger a virus specific T cell response (UGA).

-The research highlights the benefit of controlling MS infection as well as the risk of ILT CEO vaccines in MS-infected broiler flocks (UGA).

-There is an important benefit of understanding the protection afforded by different vaccine types for ILTV. Knowledge of the immune response to these vaccines provides key information for control of the disease (UGA).

-There is importance in controlling ammonia in a commercial chicken house to reduce the incidence of airsacculitis and decrease the need to use antibiotics in the flock (UGA).

-It is of ultimate importance to administering attenuated live vaccines at least 2 weeks apart to develop a better immunity to each respiratory agent and maintain it for up to 36 weeks of age (UGA).

**Objective 4. Develop new prevention and control strategies for poultry respiratory diseases.**

-It is possible to protect chickens from IBV infection by vaccination with soluble trimeric S-ectodomain protein delivered by a recombinant virus. There is potential for substantial improvement in degree of protection demonstrated by increasing the dose of recombinant vaccine virus and/or decreasing the challenge virus dose (**AU in collaboration with USPEA**).

- Outbreaks of infectious bronchitis are frequently observed in vaccinated chickens.

These outbreaks are usually the result of infection with antigenically differing IBV strains. The

current findings demonstrate that postponing vaccination beyond 1 day of age improves IBV

heterotypic protection (AU)

- Because the capacity to elicit effective neutralizing antibodies is likely related to the

ability to bind receptors, our results suggest that the context of receptor binding sites might be an

important consideration in designing recombinant vaccines (AU).

-SAPNs self-adjuvanted vaccines are good alternatives for prevention of respiratory diseases (CT).

- The popularity of a vaccine developed under regulation 9CFR PART 107.7(b) to control

an avian health issue using a homologous genotype IBV variant vaccine that was not

available from biologics manufacturers, continues to grow. No adverse reactions have

been reported by any company growing chickens in Delaware, Maryland and/or Virginia (DE).

-Vaccines that can spread from bird-to-bird would be beneficial to the poultry industry in order to protect chickens that were missed during the vaccination process. Additionally, it could provide a better vaccination strategy by inoculation of vaccine viruses through natural route of infection, potentially providing better protection against infection through the respiratory route (IL).

-IBDV vector could potentially serve as a bivalent vaccine vector for conferring protection against infectious bursal disease and other emerging and re-emerging avian and poultry infectious diseases (IN).

-Drone technology may prove to be a useful tool for developing and enhancing biosecurity programs (NE).

-Continuous fine-tuning of pc4-LAIV, by selecting the most potent interferon-inducing viral

subpopulations, along with the use of multivalent H5 and H7 formulation of pc4-LAIV may protect

chickens against the two most important subtypes of avian influenza viruses (OH).

- The litter does not have to be disposed of while infections, poultry houses can be decontaminated more efficiently. Finally, the risk of virus spread is reduced because the decontamination process is more efficient that chemical methods (SEPRL).

-Adjuvant testing leads to better HPAIV vaccines and more efficient vaccination since lower doses can be

Administered (SEPRL).

-Vaccines need to be tested periodically in order to check their effectiveness (SEPRL).

-It is important to examine not only different vaccine platforms but also vaccination strategies to maximize protection against HPAIV (SEPRL).

-These studies support the use of genetically related vaccines for emergency vaccination

programs against clade 2.3.4.4 H5Nx HPAI virus in young and adult layers (SEPRL).

-Allowing the capacity of fixation buffers to preserve surface markers while inactivating NDV, it will allow the conduction immunological studies that are necessary for production of more effective vaccines (SEPRL).

-Obtained data suggest that the rLS/IRESRFP/GFP virus may be used as a multivalent vector for the development of vaccines and gene therapy agents (SEPRL).

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-Van Santen, V., H. Toro (2018). Role of S1 N-terminal domain amino acid differences among

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-H. Toro Vicky van Santen, Kellye S. Joiner, Russell Cattley (2018). Early Vaccination Induces

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-Princess K. Botchway, Esinam N. Amuzu-Aweh, Muhammed Walugembe, Augustine Naazie,

George K. Aning, Perot Saelao, Ying Wang, Huaijun Zhou, Jack Dekkers, Sue J. Lamont, Rodrigo Gallardo, Terra R. Kelly, and Boniface B. Kayang. Genome Wide Association Analysis for Response to Newcastle Disease Virus in Local Chicken Ecotypes of Ghana. Avian Immunology Research Group meeting, Oxford, UK.

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-Reynolds, Donald L. Oral presentation. Developing and Evaluating a Biosecurity Plan.

Nebraska Poultry Industries Annual Meeting. February 21-22, 2018. Columbus, NE.

-Reynolds, Donald L. Wayne Woldt and Marcia Oetjen. The Big Red Biosecurity Program.

Oral presentation with abstract. 69th North Central Avian Disease Conference, Minneapolis,

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-Reynolds, Donald L. Wayne Woldt and Marcia Oetjen. The Big Red Biosecurity Program

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-Woldt, Wayne E., Ph.D.,P.E., Reynolds, Donald L. DVM, Ph.D., Oetjen, M., and Bhatti, S.

Unmanned Aircraft Systems for Enhanced Biosecurity Through Aerial Surveillance. Oral

paper presentation. Session title: Biosecurity for Animal Facilities. Annual International

Meeting of the American Society of Agricultural and Biological Engineers, Detroit, MI –

July 29-Aug 3, 2018.

-Habanineza, Algarde Jefferson and Donald L. Reynolds. Big Red Biosecurity Program.

Poster presentation. To be presented at the College of Agriculture and Natural Resource’s

UNL/Reynolds 5 Undergraduate Scholars Program. August 17, 2018.

-Ngunjiri JM, Abundo MC, Jang H, Elaish M, KC M, Ghorbani A, Youmans BP, Johnson TJ, Lee

CW. Understanding the respiratory microbiome of commercial turkeys and chicken layers. 98th

Annual Conference of Research Workers in Animal Diseases meeting. Chicago, IL. December

3-5, 2017.

-Jang H, Ngunjiri JM, Elaish M, Lee CW. Efficacy and Synergy of Live-attenuated and

Inactivated Influenza Vaccines in Young Chickens. 98th Annual Conference of Research

Workers in Animal Diseases meeting. Chicago, IL. December 3-5, 2017.

-Michael C. Abundo, John M. Ngunjiri, Hyesun Jang, Mohamed Elaish, Mahesh KC, Amir

Ghorbani, Bonnie P. Youmans, Timothy J. Johnson, Chang-Won Lee. Successional changes in

respiratory microbiome in clinically healthy chicken layers. 98th Annual Conference of Research

Workers in Animal Diseases meeting. Chicago, IL. December 3-5, 2017.

-Abundo MC, Ngunjiri JM, Jang H, Elaish M, KC M, Ghorbani A, Youmans BP, Johnson TJ, Lee

CW. Successional changes in respiratory microbiome and variation of microbiome in the upper

and lower respiratory tract in clinically healthy chicken layers. 69th North Central Avian Disease

Conference. Minneapolis, MN. March 12-13, 2018.

-Ngunjiri JM, Elaish M, Abundo MC, Ghorbani A, Jang H, KC M, Lee CW. Influenza virus

infection and respiratory microbiome of turkeys. 10th International Symposium on Avian

Influenza. Brighton, UK. April 15-18, 2018.

-Ngunjiri JM, KC M, Abundo MC, Elaish M, Ghorbani A, Jang H, Lee CW. Influenza virus

infection and respiratory microbiome in chickens infected with infectious bursal disease virus.

10th International Symposium on Avian Influenza. Brighton, UK. April 15-18, 2018.

-Lee CW, Jang H, Ngunjiri JM, Elaish M, Ghorbani A, KC M, Abundo M. Prime-boost vaccination

using live and inactivated virus vaccines for broader protection against avian influenza. 10th

International Symposium on Avian Influenza. Brighton, UK. April 15-18, 2018.

-Abundo MC, Ngunjiri JM, Jang H, Elaish M, KC M, Ghorbani A, Youmans BP, Jonson TJ, Lee

CW. Microbiome in the upper and lower respiratory tract and standardization of sample

collection methods in clinically healthy chicken layers. AVMA/AAAP Annual Convention,

Denver, CO. July 13-17, 2018.

-Maekawa, D., G. Beltrán, S. M. Riblet and M. García. Transmission assessment of infectious

laryngotracheitis virus (ILTV) in recombinant (r)HVT-ILT in ovo vaccinated broilers after

experimental challenge. Annual meeting of the American Association of Avian Pathologists

(AAAP). Oral presentation. Denver, CO., July 13 to 14, 2018.

-Beltrán, G., S. M. Riblet, D. J. Hurley, M. García. Changes in CD4+/CD8+ T cells in the

conjunctiva associated-lymphoid tissue (CALT) and Harderian gland (HG) during infection or

vaccination with Infectious laryngotracheitis virus (ILTV). Annual meeting of the American

Association of Avian Pathologists (AAAP). Poster presentation. Denver, CO., July 13 to 14, 2018.

-Loncoman, C. A., M. García, and S. M. Riblet and J. M. Devlin. Assessment of infectious

laryngotracheitis virus (ILTV) recombination in non-vaccinated and vaccinated chickens after coinfection with genotype V and VI virulent strains of the virus. Annual meeting of the American Association of Avian Pathologists (AAAP). Oral presentation. Denver, CO., July 13 to 14, 2018.

-García, M. Infectious laryngotracheitis commercial recombinant vaccines and vaccination

strategies. Annual meeting of the American Association of Avian Pathologists (AAAP). Oral

presentation. Denver, CO., July 13 to 14, 2018.

-S. J. Spatz, García, M., W. Fuchs, T. Ross, S. M. Riblet, T. Kim, C. A. Loncoman and J. Volkening. Reconstitution of the Infectious Laryngotracheitis Virus using Bacterial and Yeast Genomic Assembly. Annual meeting of the American Association of Avian Pathologists (AAAP). Oral presentation. Denver, CO., July 13 to 14, 2018.

-García, M. Infectious laryngotracheitis vaccination strategies. Poultry Health Day. Stratford,

Ontario Canada. June 20, 2018.

-Maekawa, D., G. Beltrán, S. M. Riblet and M. García. Protection efficacy of a Herpesvirus of

Turkey (HVT) recombinant vaccine against Infectious laryngotracheitis virus (ILTV) in broilers

administered in ovo at three standardized doses. 2nd International Avian Respiratory Disease

Conference. Oral presentation. Athens, GA., May 29 to June 1, 2018

-Beltrán, G., S. M. Williams, G. Zavala, J. S. Guy and M. García. The replication patterns of

infectious laryngotracheitis virus (ILTV) pathogenic strain and chicken embryo origin (CEO)

vaccine are ruled by the route of inoculation. 2nd International Avian Respiratory Disease

Conference. Oral presentation. Athens, GA., May 29 to June 1, 2018

-García, M. Vaccination against infectious laryngotracheitis (ILT). What we have learned and the

knowledge gaps that remain. 2nd International Avian Respiratory Disease Conference. Oral

presentation. Athens, GA., May 29 to June 1, 2018.

-Maekawa, D., G. Beltrán, S. M. Riblet and M. García. Protection efficacy of a Herpesvirus of

Turkey (HVT) recombinant vaccine against Infectious laryngotracheitis virus (ILTV) in broilers

administered in ovo at three standardized doses. Southern Conference for Avian Diseases (SCAD) Oral presentation, Atlanta, GA, January 29-30, 2018.

-Investigation of Environmental Fomites and Their Role in the Transmission of Mycoplasma

synoviae. Brandon T. Armwood, Abigail Reith, Luke Baldwin, Nils Schoof, Rosetta Barber,

Rachel Jude, Marianne Dos Santos and Naola Ferguson-Noel). American Veterinary Medical

Association (AVMA) Annual Convention, Denver, CO. July 13th -17th, 2018.

-Development of Mycoplasma gallisepticum F- Strain Vaccine Specific PCR Protocols. Naola

Ferguson-Noel, Marianne Dos Santos, and John Maurer. American Veterinary Medical

Association (AVMA) Annual Convention, Denver, CO. July 13th -17th, 2018.

-The Development of Real time PCR protocols to Differentiate Mycoplasma synoviae Vaccine

and Field Strains. Mohammadreza Ehsan, Marianne Dos Santos, Amanda Olivier and Naola

Ferguson-Noel. American Veterinary Medical Association (AVMA) Annual Convention,

Denver, CO. July 13th -17th, 2018.

-Tracheal Lesion Evaluation of broilers co-infected with Mycoplasma synoviae and Infectious

Laryngotracheitis. Valerie C Marcano, Susan M Williams, Maricarmen García, Marianne Dos

Santos, and Naola Ferguson-Noel. American Veterinary Medical Association (AVMA) Annual

Convention, Denver, CO. July 13th -17th, 2018.

-Aston, E.J., B. J. Jordan, M. Garcia and M.W. Jackwood. Effect of pullet Vaccination on

Development and Longevity of Immunity. American Association of Avian Pathologists,

AVMA Convention. Indianapolis, IN, July 2017

**Reported Grants:**

-Toro H., Q. Yu, V.L. van Santen, F.W. van Ginkel, K. Joiner. Infectious Bronchitis Virus S2

Expressed from Recombinant Virus to Confer Protection across Serotypes in Chickens. USDA/AFRI Ohio State University, 2015-2020. $246,158 (**Collaboration with SEPRL**)

-Toro, H., V.L. van Santen, R. Cattley, K. Joiner. Early Vaccination of Chickens Significantly

Decreases Induction of Infectious Bronchitis Virus Specific Immunity. USDA NIFA #2016-

67015-24916 2016-2019, $498,988

-The project titled “Improving food security in Africa by enhancing resistance to disease and heat in chickens; Feed the future innovation lab for genomics to improve poultry”, USAID AID-OAA-A- 13-00080 H. Zhou, T. Kelly, R. Gallardo, S. J. Lamont, J. Dekkers etc.

-Jarosinski, K.W. (PD) and Grose, C. (Co-PD). The role of the conserved alphaherpesvirus

glycoprotein C in host-to-host transmission. NIH/USDA-NIFA-AFRI #2018-08536; 2019-

2023, $1,624,996.

-Jarosinski, K.W. (PD). Determining the role of Marek’s disease virus UL13 protein kinase in

horizontal transmission. USDA-NIFA-AFRI #2016-67015-26777; 2016-2019, $499,838.

-Jarosinski, K.W. (PD. Determining viral factors important for generation of cell-free Marek’s

disease vaccines. USDA-NIFA-AFRI #2013-67015-26787; 2013-2016, $499,807.

-Reynolds, D. L. and W. Woldt. USDA contract for the Poultry Respiratory Disease Coordinated

Agricultural Program. $25,000/ year for 2 years. Big Red Biosecurity Program: A Comprehensive

Educational Biosecurity Program for Nebraska Poultry That Explores Use of Unmanned Aircraft

Systems (Drone) Technology. 2018. 2nd year funded Sept. 2018.

-Reynolds, D. L. and Jay Reddy. USDA contract for the Poultry Respiratory Disease Coordinated

Agricultural Program. $25,000. Immune Conditioning for Better Respiratory Disease Protection.

Funded July, 2018.

-Reynolds, D. L. Nebraska Poultry Industries. Biosecurity Assessment of In-House Composting for

Use with Routine Mortalities. $5,000. Sept. 2018.

-Lee CW. USDA contract (SCA58-6040-7-005). $65,000. Transmission of influenza viruses

to turkeys. 2018.