**SAES-422 – NC229 Accomplishments Report**

**Project/Activity Number:** NC-229

**Project/Activity Title:** PRRSV and other emerging viral diseases of swine

**Period Covered:** 11/3/2019 to 12/5/2020

**Date of report:** 02/05/2021

**Annual Meeting Date: 12/05/2020**

**Participants:** Eric, Nelson (eric.nelson@sdstate.edu)-South Dakota State University; Osorio, Fernando A (fosorio@unl.edu)- and Vu, Hiep (hiepvu@unl.edu)University of Nebraska-Lincoln; Rowland, Raymond (browland@vet.k-state.edu)-Kansas State University; Benfield, David, (benfield.2@osu.edu) Ohio State University; Timothy, Sullivan (timothy.sullivan@usda.gov)-USDA-NIFA/Kansas: USDA; Lunney, Joan (joan.lunney@ars.usda.gov)-USDA-ARS, BARC; Gourapura, Renukaradhya (gourapura.1@osu.edu)-The Ohio State University (OSU); Schroeder, Declan (deschroe@umn.edu)-University of Minnesota; Pogranichniy Roman (rmp@vet.k-state.edu); Kansas State University-Ramamoorthy, S (sheela.ramamoorthy@ndsu.edu)- North Dakota St Univ (N.D.); Zhang, Yanjin (zhangyj@umd.edu)- University of Maryland; Pablo Pineyro (pablop@iastate.edu)-Iowa State University; Zuckermann, Federico (fazaaa@illinois.edu)- University of Illinois at Urbana-Champaign.

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

The 2020 NC229 meeting was held December 5, 2020, as a viirtual meeting on the zoom platform. The meeting was open to all NC229 members. Annaul reports from 15 stations were shared with the audience by speakers selected by the station rpresentatives for each station. More than 50 participants accessed the meeting online. The agenda is presented in Table 1. The business meeting centered on the topics noted below:

1. Drs. Ramamoorthy (Chair) and Dr. Fernando Osorio (academic advisor) inaugurated the annual NC229 scientific meeting.
2. Drs. Ramamoorthy (Chair) and Roman Pogranichniy (Vice-Chair), and the scientific program committee were recognized for their outstanding efforts in organizing the scientific program for the online meeting.
3. Dr. Fernando Osorio discussed two major accomplishments, publication of the manuscript entitled "The NC229 multi-station research consortium on emerging viral diseases of swine: Solving stakeholder problems through innovative science and research” for a special edition on multi-state consortia in Virus Research, describing the history and accomplishments of NC229. He also informed the audience about the successful renwal of the project for the next 5 years.
4. Dr. Tim Sullivan & Dr. Mark Mirando presented updates regarding funding opportunities for the upcoming year. Two significant changes were announced: 1) update on minimum funding amount. 2) New investigators seed grants.
5. Additional funding opportunities were discussed related to Interagency funding opportunities: 1) Ecology and evolution on infectious diseases, and 2) Dual Purpose with Dual Benefits: Research in Biomedical and Agriculture Using Agriculturally important Domestic animals which might be renwed
6. Dr. Raymond Rowland, University of Illinois Urbana Champaign , who is a long standing member of NC229 and currently as an admisntrator, agreed to replace Dr. Fernando Osorio as the academic advisor of NC229, as Dr. Osorio had consented to serve as the interim advisor after the departure of Dr. Benfield.
7. Dr. Ying Fang led a discussion on seeking input from the group on changes to the format and location for the joint meeting of the North American PRRSV symposium and NC229 and separation of this satellite meeting from CRWAD.

**Table: 1**

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| **Meeting Agenda Time**  | **Presenter/ Station/Title**  |
| 8.00am – 8.05am  | Dr. Fernando Osorio –Advisor; Sheela Ramamoorthy –/Chair **Opening remarks**  |
| 8.05am-8.45am  | Dr. Tim Sullivan & Dr. Mark Mirando National Program Leaders, Animal Production Systems, USDA- NIFA **Updates on funding and opportunities**  |
| 8.45am-8.55am  | Linhares D; Iowa State University; **Overview of studies on PRRS** **monitoring and control under field conditions**  |
| 8.55am – 9.05am  | Nelli R; Iowa State University; **3D culture systems as infection Models for swine diseases**  |
| 9.05am-9.15am  | Shi J and Niederwerder M, Kansas State University;**Update on PRRS, ASF andCSF research**  |
| 9.15am-9.25am  | Wang X; South Dakota State University; **Role of host restriction factors in PRRSV replication**  |
| 9.25am-9.35am  | Pasternak A; Purdue University; **A genome-wide association study (GWAS) of thyroid hormone levels In piglets challenged with PRRSV**  |
| 9.35am-9.45am  | Van Goor A; BARC USDA. **Understanding the impact of RRSV infection on the Fetus**  |
| 9.45am-9.50am  | Miller LC; NADC; **An overview of research at the National Animal Disease Center on endemic and emerging viral diseases of swine**  |
| 9.50am -10.00am  | VanderWaal K; University of Minnesota; **From Pathogen to Populations:** **Building a multi-scale understanding of how porcine viruses evolve, adapt, spread, and persist**  |
| 10.00am-10.10am  | Vu H; University of Nebraska-Lincoln; **A simple and reliable method for** **quantification of swine antibody response to PRRSV infection**  |
| 10.10am-10.20am  | Osorio F; University of Nebraska-Lincoln; **Novel characterization of tropism PRRSV for swine epithelial Testicular cells**  |
| 10.20am-10.30am  | Gourapura R; Ohio State University; **Novel vaccine delivery platforms to enhance immunity to influenza in maternal antibody positive grow- finisher pigs**  |
| 10.30am-10.40am  | Zuckerman F; University of Illinois; **The porcine macrophage cell line** **ZMAC and its potential use for ASF virus vaccine production**  |
| 10.40am-11.00am (extra time is blocked in case station reports run over)  | Dr. Ying Fang and Dr. Fernando Osorio **NA PRRS/NC 229 annual meeting reorganization** Academic advisor (AA) replacement  |

**Accomplishments:** The introduction of foreign animal diseases (FADs) such as ASF, CSF, FMD into the U.S is a looming threat to the pork industry. Monitoring and preventing current endemic pathogens such as PRRSV, IAV, and PCV still remains a challenge. Collectively the major areas of progress include animal feed safety, ASFV detection/ prevention, molecular diagnostic test development for FADs. In addition, establishment of the swine health information center (SHIC) a multidisciplinary and multistate monitoring system for endemic diseases provides real-time information to producers and veterinaries.

**Short-term Outcomes:** No outcomes to report at this time.

**Outputs:** The Swine Disease Reporting System (SDRS) was launched to aggregate real time data from participating veterinary diagnostic laboratories (VDLs) in the United States of America (ISU, U of M, SDSU, and KSU) and reports the significant findings to the swine industry

A cell line for the laboratory culture of AFSV was established

The survival and transmissibility of AFSV in animal feed was determined, along with information on specific feed ingrediants that either promote or inhibit viral replication.

**Activities:**

* The Swine Disease Reporting System (SDRS) has been providing monthly reports through multiple platforms (newsletters, podcasts, and YouTube videos) of the major disease trends. The collated cumulative data from the major Veterinary diagnostic laboratories also provides the opportunity to forecast the behavior of different diseases in specific production areas of the country
* The NC 229 multistate annual meeting helped to disseminate the scientific advances contemplated within this project's objectives. More than 15 researchers share the advances on PRRSV immunology/vaccinology and epidemiology.

**Milestones:**

**Impacts:** In the 2nd year of this 5 year project renewal, major impacts from multi-state efforts included improvements in dissemination of information regarding trends in animal infections, where data generated through SDRS is used daily by practitioners to make relevant decisions regarding biosecurity and prevention strategies of endemic pathogens, and development of models and generating data to inform best practices on formulation and transport of animal feed to reduce the risk of FAD introduction via feed and feed ingredients.

**Publications from multi-station collaborations:**

1. Gilbert P; Megan CN; Gordon S; Scott AD. Quantification of soya-based feed ingredient entry from ASFV-positive countries to the United States by ocean freight shipping and associated seaports. ***Transbound Emerg Dis*** . 2020 October 16. doi: 10.1111/tbed.13881.
2. Niederwerder MC; Dee S; Diel DG; Stoian AMM; Constance LA; Olcha M; Petrovan V; Patterson G; Cino-Ozuna AG; Rowland RRR. Mitigating the risk of African swine fever virus in feed with anti-viral chemical additives. ***Transbound Emerg Dis*** 2020 July 2. doi: 10.1111/tbed.13699.
3. Dee S; Shah A; Cochrane R; Clement T; Singrey A; Edler R; Spronk G; Niederwerder M; Nelson E.Use of a demonstration project to evaluate viral survival in feed: Proof of concept. ***Transbound Emerg Dis*** . 2020 June 14. doi: 10.1111/tbed.13682. Online ahead of print.
4. Ricker N; Trachsel J; Colgan P; Jones J; Choi J; Lee J; Coetzee JF; Howe A; Brockmeier SL; Loving CL; Allen HK.Toward Antibiotic Stewardship: Route of Antibiotic Administration Impacts the Microbiota and Resistance Gene Diversity in Swine Feces . ***Front. Vet. Sci.,*** May 19 2020 | https://doi.org/10.3389/fvets.2020.00255
5. Lerner AB; Cochrane RA; Gebhardt JT; Dritz S.S.; Jones CK; DeRouchey JM; Tokach M; Goodband RD; Bai J; Porter E; Anderson J; Gauger PC, Magstadt DR; Zhang J; Bass B; Karnezos T; de Rodas B; Woodworth JC**.** Effects of medium chain fatty acids as a mitigation or prevention strategy against porcine epidemic diarrhea virus in swine feed. ***J Anim Sci*** 2020 June 1;98(6):skaa159. doi: 10.1093/jas/skaa159.
6. Dee SA; Niederwerder MC; Patterson G; Cochrane R; Jones C; Diel D; Brockhoff E; Nelson E; Spronk G; Sundberg P.The risk of viral transmission in feed: What do we know, what do we do?. ***Transbound Emerg Dis***. 2020 Nov;67(6):2365-2371. doi: 10.1111/tbed.13606.
7. Jackman JA; Boyd RD; Elrod CC**.** Medium-chain fatty acids and monoglycerides as feed additives for pig production: towards gut health improvement and feed pathogen mitigation. ***J Animal Sci Biotechnol*** 11**,**44 (2020). https://doi.org/10.1186/s40104-020-00446-1
8. Stoian AMM; Petrovan V; Constance LA; Olcha M; Dee S; Diel DG; Sheahan MA; Rowland RRR; Patterson G; Niederwerder MC. Stability of classical swine fever virus and pseudorabies virus in animal feed ingredients exposed to transpacific shipping conditions. ***Transbound Emerg Dis*** 2020 Jul;67(4):1623-1632. doi: 10.1111/tbed.13498. Epub 2020 Feb
9. Gebhardt JT; Thomson KA; Woodworth JC; Dritz S.S.; Tokach MD; DeRouchey JM; Goodband RD; Jones CK; Cochrane RA; Niederwerder MC; Fernando S; Abbas W; Burkey TE. Effect of dietary medium-chain fatty acids on nursery pig growth performance, fecal microbial composition, and mitigation properties against porcine epidemic diarrhea virus following storage. ***J Anim Sci***. 2020 January 1;98(1):skz358.  doi: 10.1093/jas/skz358.
10. Wang Y; Yim-Im W; Porter E; Lu N; Anderson J; Noll L; Fang Y; Zhang J; Bai J. Development of a bead-based assay for detection and differentiation of field strains and four vaccine strains of type 2 porcine reproductive and respiratory syndrome virus (PRRSV-2) in the USA. ***Transbound Emerg Dis***. 2020 August 20. doi: 10.1111/tbed.13808. Online ahead of print.
11. Shang P; Yuan F; Misra S; Li Y; Fang Y. Hyper-phosphorylation of nsp2-related proteins of porcine reproductive and respiratory syndrome virus. ***Virology***. 2020 Apr;543:63-75. doi: 10.1016/j.virol.2020.01.018. Epub 2020 February 4.
12. Jara M; Rasmussen DA; Corzo CA; Machado G. Porcine reproductive and respiratory syndrome virus dissemination across pig production systems in the United States. ***Transbound Emerg Dis.*** 2020 July 13. doi: 10.1111/tbed.13728. Online ahead of print.
13. Trevisan G; Linhares LCM; Crim B; Dubey P; Schwartz KJ; Burrough ER; Wang C; Main R.G.; Sundberg P; Thurn M; Lages PTF; Corzo CA; Torrison J; Henningson J; Herrman E; Hanzlicek GA; Raghavan R; Marthaler D; Greseth J; Clement T; Christopher-Hennings J 5; Muscatello D 6; Linhares DC1. Prediction of seasonal patterns of porcine reproductive and respiratory syndrome virus RNA detection in the U.S. swine industry. ***J Vet Diagn Invest***. 2020 May;32(3):394-400. doi: 10.1177/1040638720912406. Epub 2020 April 10.
14. Benfield D; Lunney JK; Murtaugh M; Nelson E; Osorio F; Pogranichniy R; Ramamoorthy S; Rowland RRR; Zimmerman JJ; Zuckermann FA. The NC229 multi-station research consortium on emerging viral diseases of swine: Solving stakeholder problems through innovative science and research. ***Virus Res***. 2020 April 15;280:197898. doi: 10.1016/j.virusres.2020.197898. Epub 2020 February 28
15. Benfield D; Lunney JK; Murtaugh M; Nelson E; Osorio F; Pogranichniy R; Ramamoorthy S; Rowland RRR; Zimmerman JJ; Zuckermann FA. The NC229 multi-station research consortium on emerging viral diseases of swine: Solving stakeholder problems through innovative science and research. ***IPVS 2020 Proceedings*** Rio de janeiro page 761. Base on paper No. 14.