**Accomplishment Summaries (focus on novel discoveries and collaboration efforts):**

1. Transmissibility studies determined the transmissibility efficiency of swine influenza virus from vaccinated pigs **(South Dakota State University)**
2. The PRRSV variability within different farms types (breeding and growing pig herds) and PRRS management strategies (vaccination, active outbreaks) was evaluated. (**The Ohio State University, University of Minnesota)**
3. Influenza vaccine efficacy studies demonstrated that intranasal delivery of Nano-11 and Poly(I:C) based inactivated SwIAV vaccine induce polyfunctional and cross-protective cell-mediated immunity. (**The Ohio State University, Purdue University)**
4. A monoclonal antibody-based blocking ELISA to detect antibody responses to Senecavirus A (SVA) was validated and licensed for commercialization **(South Dakota State University)**.
5. Monoclonal antibodies were developed for a DIVA-based, diagnostic ELISA for detection of vaccinated versus naturally infected animals **(USDA, (South Dakota State University)**
6. The role of porcine parvovirus 2 as causative of interstitial pneumonia in pigs was evaluated by genomic and in situ detection **(South Dakota State University).**
7. Preliminary studies explored the role of porcine rotavirus and canine parvorius on respiratory disease in pigs. **(South Dakota State University).**
8. The development of unique BacMam-vectored swine influenza virus vaccine based on the influenza neuraminidase gene showed significant protection by reduction of viral elimination, pulmonary lesions and increasing antibody response **(South Dakota State University).**
9. The first United States Swine Pathogen Database platform to integrate veterinary diagnostic laboratory sequence data was create to monitor emerging pathogens of swine and to combine and compare with sequences deposited in GenBank. **(ARS, Iowa State University, Kansas State University, South Dakota State University, and Cornell University)**
10. Susceptibility studies demonstrated SARS-CoV2 lack of susceptibility on swine and cattle, but not in whitetail deer **(USDA, Cornell University**
11. A novel recombinant cDNA system was developed to study porcine deltacoronavirus (PDCoV) and successfully yielded an infectious virus . This recombinant virus can now be utilized to generate vaccine candidates with modified specific regions that have been shown to suppress the host immune response (**ARS, Loyola University)**
12. We demonstrated during fetal infection, PRRSV produce an endocrine disruption, reducing animal performance. Additional studies showed that thyroid hormone levels may be promising biomarkers for genetic improvement of resilience during PRRSV challenge in addition to the development of a multiple methods of gene expression and SNP analysis to elucidate the PRRSV- induced hypothyroidism**(ARS, USDA, Purdue University, University of Saskatchewan)**
13. Intestinal microbiota studies identified gut microbes associated with improved weight gain on pigs after immunization with PRRS MLV vaccine and co-challenge with PRRSV/PCV2, which may increase the efficacy of PRRS vaccination. **(Kansas State University, Lawrence Livermore National Laboratory, Iowa State University)**
14. We determined the risk and mitigation of ASFV in animal feed in addition we also validate the use of feed dust swabs as a proof-of-concept diagnostic sample for detection of ASFV contamination of animal feed **(Kansas State University)**
15. Evaluation of a commercial MLV PRRS vaccine against the highly pathogenic PRRV virus strain from China showed to be protective in *in vivo* experimental protection challenge. **(Kansas State University)**
16. A potential ASF candidate vaccine was successfully evaluated. This vaccine platform utilized a ASF mutant containing several gene-deletions on the parental ASFv -Vietnam19 strain. **(Kansas State University)**
17. We development of a blocking ELISA for detection of antibodies against ASFV **(University of Illinois, Kansas State University, Iowa State University)**
18. Developed in vivo expression vectors to express neutralizing anti-CSFv antibodies. **Kansas State University)**
19. Patent: A porcine circovirus type 2 vaccine.. PCT/US2020/043770. WO 2021/021753 A2, Patent published March 2021 **(South Dakota State University, Keystone Bio)**
20. The survival of Senecavirus A (SVA) in feed and its transmissibility and infectivity through contaminated feed was demonstrated. SVA can survive for extended period in feed ingredient and the virus is efficiently transmitted through ingestion of contaminated feed. **(Cornell University, South Dakota State University, Pipestone Group , Kansas State University**
21. We developed next generation sequencing protocols for PRRSV and Senecavirus A. These procedures allow rapid detection and sequencing of whole genomes of PRRSV and SVA directly from clinical samples. **(Cornell University, Iowa State University, UCDavis)**
22. The immunogenicity and protective efficacy of novel swine influenza vaccine candidates was evaluated in pigs. **(Cornell University, South Dakota State University, Iowa State University The Ohio State University)**
23. Based on a reverse genetics system we created a virulent and pathogenic infectious clone of Senecavirus A **(Cornell University, South Dakota State University, Universidade Federal de Pelotas)**
24. Targeting suicidal replication we created a PCV2 vaccine that enhance the safety of attenuated vaccines. **(North Dakota State University, Iowa State University, South Dakota State University)**
25. Evaluation of different disinfection conditions associated with thermo-assisted drying and decontamination inconsistently produce negative PRRSV rRT-PCR results on metal surfaces
26. Establishment of disinfection conditions associated with thermo-assisted drying and on metal surfaces. **(Iowa State University)**
27. Experientially studies demonstrate that porcine parainfluenza virus type 1 can induce mild upper respiratory disease in pigs perhaps contribute to the SRDC. **(Iowa State University)**
28. A novel reverse transcription real-time PCR assay has been validated for detection of PRRSVvaccine-like virus. **(Iowa State University)**
29. Evaluation of the efficacy of ultraviolet C exposure demonstrated that could be an efficient method for inactivating Senecavirus A on contaminated surfaces on swine farms. **(Iowa State University)**
30. Evaluation of performance ZMAC and MARC-145 cell lines for improving PRRSV virus isolation from clinical samples demonstrated that both cell are capable to detect coinfection with multiple PRRSV strains. **(Iowa State University)**
31. Epidemiological studies have established key performance indicators and PRRSV shedding over time in a naïve breeding herd following a PRRS MLV exposure. **(Iowa State University)**
32. Develop and validate a high-throughput system for simultaneous quantification of swine antibody responses to different proteins of ASFV **(Kansas State University**)
33. The evaluation of Swine Leukocyte Antigen II (SLAII) was found to be associated with PCV2 replication and PRRSV immune response in addition a novel genotyping tool for dissection the SLA regions was develop-end to evaluate SLA effect in viral disease susceptibility
34. **(University of Nebraska-Lincoln)**
35. Genomic analysis uncovered a conserved genomic region of APPV that could be exploited as a site for a diagnostic test able to detect multiple any APPV strain. **(University of Nebraska-Lincoln)**

**Publications result of multistation collaborations:**

# Porcine reproductive and respiratory syndrome virus (PRRSV)

1. Trevisan G, Linhares L, Crim B, Dubey P, Schwartz KJ, Burrough ER, Wang C, Main RG, Sundberg P, Thurn M, Lages P, Corzo CA, Torrison J, Henningson J, Herrman E, Hanzlicek GA, Raghavan R, Marthaler D, Greseth J, Clement T, Christopher-Hennings J, Linhares D. Prediction of seasonal patterns of porcine reproductive and respiratory syndrome virus (PRRSV) RNA detection in the US swine industry. *J Vet Diagn Invest* 2020; 32(3):394-400.
2. Trevisan Gt, Johnson C, Benjamin N, Bradner L, Linhares DCL. Description of changes of key performance indicators and PRRSV shedding over time in a naïve breeding herd following a PRRS MLV exposure. Transboundary and Emerging Diseases. 2021; 68(6): 3230-3235.
3. Trevisan G, Linhares LCM, Schwartz KJ, Burrough ER, Magalhaes ES, Crim B, Dubey P, Main RG, Gauger P, Thurn M, Lages PTF, Corzo CA, Torrison J, Henningson J, Herrman E, Mcgaughey R, Cino G, Clement T, Greseth J, Christopher-Hennings J, Linhares DCL. Data standardization implementation and applications within and among diagnostic laboratories: integrating and monitoring enteric coronaviruses. Journal of Veterinary Diagnostic Investigation. 2021;33(3):457-468. doi:10.1177/10406387211002163.
4. Sanglard LP, Hickmann FMW, Huang Y, Gray KA, Linhares DCL, Dekkers JCM, Niederwerder MC, Fernando RL, Braccini Neto J, Serão NVL. Genomics of response to PRRSV in purebred and crossbred sows: antibody response and performance following natural infection versus vaccination. J Anim Sci. 2021; 99(5):1-15. doi: 10.1093/jas/skab097.
5. Sykes AL, Silva GS, Holtkamp DJ, Mauch BW, Osemeke O, Linhares DCL, Machado G. Interpretable machine learning applied to on-farm biosecurity and porcine reproductive and respiratory syndrome virus. Transboundary and Emerging Diseases. 2021: https://doi.org/10.1111/tbed.14369].
6. Holtkamp D, Torremorell M, Corzo CA, Linhares DCL, Almeida MN, Yeske P, Polson DD, Becton L, Snelson H, Donovan T, Pittman J, Johnson C, Vilalta C, Silva GS, Sanhueza J. Proposed modifications to porcine reproductive and respiratory syndrome virus herd classification. *J Swine Health Prod*. 2021; 29(5): 261-270.
7. Almeida MN, Corzo CA, Zimmerman JJ, Linhares DCL. 2021. Longitudinal piglet sampling in commercial sow farms highlights the challenge of PRRSV detection. Porcine Health Manag 7:31.
8. Almeida MN, Zhang M, Lopez WAL, Vilalta C, Sanhueza J, Corzo CA, Zimmerman JJ, Linhares DCL. 2021. A comparison of three surveillance approaches for detecting PRRSV in suckling piglets. Prev Vet Med 194:105427.
9. Wang Y, Yim-im W, Porter E, Lu N, Anderson J, Noll L, Fang Y, Zhang J, Bai J. (2021). 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. *Transboundary and Emerging Diseases*. 68: 1414-1423.
10. Yim-Im W, Huang H, Park J, Wang C, Calzada G, Gauger P, Harmon K, Main R, Zhang J. (2021). Comparison of ZMAC and MARC-145 cell lines for improving PRRSV virus isolation from clinical samples. *Journal of Clinical Microbiology*. 59(3): e01757-20.
11. Magnus R. Campler, Ting-Yu Cheng, Declan C. Schroeder, My Yang, Sunil K. Mor, Juliana B. Ferreira, Andréia. G. Arruda. A longitudinal study on PRRSV detection in swine herds with different demographics and PRRSV management strategies. Transboundary and Emerging Diseases. 2021 https://doi.org/10.1111/tbed.14386
12. Heather L. Walker; Andrew S. Bowman, Juliana B. Ferreira; Sarah W. Nelson; Monique Pairis-Garcia; Andreia G. Arruda. Tonsil scrapings for porcine reproductive and respiratory syndrome virus detection in growing pigs under field conditions. Journal of Swine Health and Production. 2021; 29(2):72-80.
13. Schroeder, D., N. Odogwu, J. Kevill, M. Yang, V. Krishna, M. Kikuti, N. Pamornchainavakul, C. Vilalta, J. Sanhueza, C. Corzo, A. Rovira, S. Dee, E. Nelson, A. Singrey, P. Zhitnitskiy, C. Balestreri, D. Makau, I. Paploski, M. Cheeran, K. VanderWaal, M. Torremorell. Phylogenetically distinct near complete genomes of porcine reproductive and respiratory syndrome virus type-2 variants from four distinct disease outbreaks in US swine farms over the past 6 years. 2021. Microbiology Resource Announcements. doi: 10.1128/MRA.00260-21.
14. Pasternak JA, MacPhee DJ, Lunney JK, Rowland RRR, PigGen Canada, Dyck MK, Fortin F, Dekkers JCM, Plastow GS, Harding JCS “Thyroid dysfunction in feeder pigs following polymicrobial or porcine reproductive and respiratory syndrome virus-2 challenge” Accepted-In Press (JAS-2021-5821)
15. Decreased tight junction protein intensity in the placenta of porcine reproductive and respiratory syndrome virus-2 infected fetuses. Guidoni PB, Pasternak JA, Hamonic G, MacPhee DJ, Harding JCS. Placenta. 2021 Sep 1;112:153-161. doi: 10.1016/j.placenta.2021.07.300. Epub 2021 Jul 29. PMID: 34352491
16. Fetal hypoxia and apoptosis following maternal porcine reproductive and respiratory syndrome virus (PRRSV) infection. Malgarin CM, Moser F, Pasternak JA, Hamonic G, Detmer SE, MacPhee DJ, Harding JCS. BMC Vet Res. 2021 May 1;17(1):182. doi: 10.1186/s12917-021-02883-0. PMID: 33933084
17. Van Goor A, Pasternak A, Walker K, Hong L, Malgarin C, MacPhee DJ, Harding JCS, Lunney JK. Differential responses in placenta and fetal thymus at 12 days post infection elucidate mechanisms of viral level and fetal compromise following PRRSV2 infection. BMC Genomics. 2020 Nov 4;21(1):763. doi: 10.1186/s12864-020-07154-0. PMID: 33148169
18. Constance LA, Thissen JB, Jaing CJ, McLoughlin KS, Rowland RRR, Serão NVL,Cino-Ozuna AG, Niederwerder MC. Gut microbiome associations with outcome following co-infection with porcine reproductive and respiratory syndrome virus (PRRSV) and porcine circovirus type 2 (PCV2) in pigs immunized with a PRRS modified live virus vaccine. Vet Microbiol. 2021 Mar;254:109018. doi: 10.1016/j.vetmic.2021.109018. Epub 2021 Feb 16. PMID: 33639341.
19. Sanglard LP, Hickmann FMW, Huang Y, Gray KA, Linhares DCL, Dekkers JCM, Niederwerder MC, Fernando RL, Braccini Neto J, Serão NVL. Genomics of response to porcine reproductive and respiratory syndrome virus in purebred and crossbred sows: antibody response and performance following natural infection vs. vaccination. J Anim Sci. 2021 May 1;99(5):skab097. doi: 10.1093/jas/skab097. PMID: 33782709; PMCID: PMC8118356.
20. Fleming, D.S., Miller, L.C. 2020. Integrative genomics and network biology in livestock and other domestic animals: differentially expressed miRNAs and tRNA genes affect host homeostasis during highly pathogenic porcine reproductive and respiratory syndrome. Frontiers in Genetics. p. 150. <https://doi.org/10.3389/978-2-88963-999-1>.
21. Chaudhari J., Liew CS, Riethoven JJ, Sillman S., and Vu H., 2021. Porcine reproductive and respiratory syndrome virus infection upregulates negative immune regulators and T cell exhaustion markers. *J Virol. 2021 Oct 13;95(21):e0105221. doi: 10.1128/JVI.01052-21. Epub 2021 Aug 11.*

# Swine Influenza A (IAV)

1. Sankar Renu , Ninoshkaly Feliciano-Ruiz, Veerupaxagouda Patil, Jennifer Schrock, Yi Han, Anikethana Ramesh, Santosh Dhakal, Juliette Hanson, Steven Krakowka, Gourapura J Renukaradhya. Immunity and Protective Efficacy of Mannose Conjugated Chitosan-Based Influenza Nanovaccine in Maternal Antibody Positive Pigs. Front Immunol. 2021 Mar 4;12:584299.
2. Veerupaxagouda Patil, Sankar Renu, Ninoshkaly Feliciano-Ruiz, Yi Han, Anikethana Ramesh, Jennifer Schrock, Santosh Dhakal, Harm HogenEsch, Gourapura J Renukaradhya. Front Immunol. 2020 Dec 16;11:596964. Intranasal Delivery of Inactivated Influenza Virus and Poly(I:C) Adsorbed Corn-Based Nanoparticle Vaccine Elicited Robust Antigen-Specific Cell-Mediated Immune Responses in Maternal Antibody Positive Nursery Pigs
3. Wang Z, Yu J, Sheng Z, Hause BM, Li F, Kaushik RS, Wang D. Functional study of a role of N-terminal HA stem region of swine influenza virus in virus replication. 2021. Veterinary Microbiology 258:109132.
4. Yu, J., C. Sreenivasan, T. Uprety, R. Gao, C. Huang, E. Lee, S. Lawson, J. Nelson, J. Christopher-Hennings, R. Kaushik, E. Nelson, D. Diel, B. Hause, F. Li, D. Wang. Piglet Immunization with a Spike Subunit Vaccine Enhances Disease by Porcine Epidemic Diarrhea Virus. 2021. NPJ Vaccines. doi: 10.1038/s41541-021-00283.
5. Fleming, D.S., Miller, L.C., Tian, Y., Li, Y., Ma, W., Sang, Y. 2020. Impact of porcine arterivirus, influenza B, and their coinfection on antiviral response in the porcine lung. Pathogens. 9(11): 934. <https://doi.org/10.3390/pathogens9110934>.
6. Joshi, L.R., Knudsen, D., Pineyro, P., Dhakal, S., Renukaradhya, G.J., Diel, D.G. Protective efficacy of an orf virus-vector encoding the hemmagglutinin and the nucleoprotein of influenza A virus in swine. Accepted, *Frontiers in Immunology.* bioRxvi, *doi:* https://doi.org/10.1101/2021.04.19.440556. 2021.

# African Swine Fever (ASF)

1. 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. 2021 Mar;68(2):477-486. doi: 10.1111/tbed.13699. Epub 2020 Jul 11. PMID: 32613713.
2. Patterson G, Niederwerder MC, Spronk G, Dee SA. 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. 2021 Jul;68(4):2603-2609. doi: 10.1111/tbed.13881. Epub 2020 Oct 30. PMID: 33064921; PMCID: PMC8359260.
3. Niederwerder MC. Risk and Mitigation of African Swine Fever Virus in Feed. Animals (Basel). 2021 Mar 18;11(3):792. doi: 10.3390/ani11030792. PMID: 33803495; PMCID: PMC7998236.
4. Khanal P, Olcha M, Niederwerder MC. Detection of African swine fever virus in feed dust collected from experimentally inoculated complete feed using quantitative PCR and virus titration assays. Transbound Emerg Dis. 2021 Jun 15. doi: 10.1111/tbed.14176. Epub ahead of print. PMID: 34132048.
5. Truong, Q.L., L. Nguyen, H. Nguyen, J. Shi, H. Vu, H. Lai, and G. Nguyen. 2021. Whole-genome Sequence of a Virulent African Swine Fever Virus isolated in 2020 from a Domestic Pig in Northern Vietnam. Microbiology Resource Announcement. Vol.10: Iss. 19 e00193-21. <https://doi.org/10.1128/MRA.00193-21>
6. Shi, J., L. Wang, D.S. McVey. 2021. Of pigs and men: the best-laid plans for prevention and control of swine fevers. Animal Frontiers. Open Access. Published on Feb. 5, 2021. Animal Frontiers. 11(1):6–13. https://doi.org/10.1093/af/vfaa052
7. Yuan F, Petrovan V, Giménez-Lirola L, Zimmerman J, Rowland RRR, Fang Y. (2021). Development of a Blocking Enzyme-Linked Immunosorbent Assay for Detection of Antibodies Against African Swine Fever Virus. Pathogens. 2021 Jun 17;10(6):760. doi: 10.3390/pathogens10060760.
8. Luong Q.H., Lai T.L.H., Do L.D., Ha X.B., Nguyen V.G. and Vu H.L\*., 2021. Differential antibody responses in sows and finishing pigs naturally infected with African swine fever virus under field conditions. *Virus Res. 2022 Jan 2;307:198621. doi: 10.1016/j.virusres.2021.198621*
9. Kennedy M, Delhon G, McVey DS, Vu H, and Borca M. 2021. Chapter 49: Asfarviridae and Iridoviridae. Veterinary Microbiology 4th Edition

# Feed contaminants

1. Dee, S., A. Shah, R. Cochrane, F. Wu, T. Clement, A. Singrey, R. Elder, G. Spronk, M. Niederwerder, E. Nelson. The effect of extended storage on virus survival in feed. 2021. J. Swine Health & Production. 29(3):124-128.
2. Dee, S., A. Shah, C. Jones, A. Singrey, D. Hanson, R. Edler, G. Spronk, M. Niederwerder, E. Nelson. Evidence of viral survival in representative volumes of feed and feed ingredients during long-distance commercial transport across the continental United States. 2021. Transboundary and Emerging Diseases. [doi.org/10.1111/tbed.14057](http://doi.org/10.1111/tbed.14057).
3. Dee, S., M. Niederwerder, R. Elder, D. Hanson, A. Singrey, R. Cochrane, G. Spronk, E. Nelson. An evaluation of additives for mitigating the risk of virus-contaminated feed using an ice-block challenge model. 2021. Transboundary and Emerging Diseases. doi:10.1111/tbed.13749.
4. Dee, S., A. Shah, R. Cochrane, A. Wu, T. Clement, A. Singrey, R. Edler, G. Spronk, M. Niederwerder, E. Nelson. Use of a demonstration project to test the effect of extended storage on viral survival in feed: Proof of concept. 2020. Transboundary and Emerging Diseases. doi: 10.1111/tbed.13682.
5. Dee, S., M. Niederwerder, G. Patterson, R. Cochrane, C. Jones, D. Diel, E. Nelson, G. Spronk, E. Brockhoff, P. Sundberg. The risk of viral transmission in feed: What do we know, what do we do? 2020. Transboundary and Emerging Diseases. doi: 10.1111/tbed.13606.
6. Stenfeldt C, Bertram MR, Meek HC, Hartwig EJ, Smoliga GR, Niederwerder MC, Diel DG, Dee SA, Arzt J. The risk and mitigation of foot-and-mouth disease virus infection of pigs through consumption of contaminated feed. Transbound Emerg Dis. 2021 Jul 8. doi: 10.1111/tbed.14230. Epub ahead of print. PMID: 34237198.

# Pseudorabies virus (PRV)

1. Cheng, T., Henao-Diaz, A., Poonsuk, K., Buckley, A.C., Van Geelen, A., Lager, K.M., Harmon, K., Gauger, P., Wang, C., Ambagala, A., Zimmerman, J., Gimenez-Lirola, L. 2021. Pseudorabies (Aujeszky's disease) virus DNA detection in swine nasal swab and oral fluid specimens using a gB-based real-time quantitative PCR. Preventive Veterinary Medicine. 189. Article 105308. <https://doi.org/10.1016/j.prevetmed.2021.105308>.
2. Cheng T, Magtoto R, Henao-Dìaz A, Poonsuk K, Buckley A, van Geelen A, Lager K, Zimmerman J, Giménez-Lirola L. (2021). Detection of pseudorabies virus antibody in swine oral fluid specimen using recombinant glycoprotein indirect ELISAs. J Vet Diagn Invest. 2021 Aug 27:10406387211040755. doi: 10.1177/10406387211040755.
3. Cheng TY, Buckley A, van Geelen A, Lager K, Henao-Díaz A, Poonsuk K, Piñeyro P, Baum D, Ji J, Wang C, Main R, Zimmerman J, Giménez-Lirola L\*. (2020). Proof of concept: Detection of pseudorabies virus antibody in swine oral fluid using a whole virus indirect ELISA. Journal Veterinary Diagnostic Investigation, Journal of Veterinary Diagnostic Investigation, 32(4):535-541.
4. Cheng TY, Henao-Diaz A, Poonsuk K, Buckley A, van Geelen A, Lager K, Harmon K, Gauger P, Wang C, Ambagala A, Zimmerman J, Giménez-Lirola L. 2021. Pseudorabies (Aujeszky's disease) virus DNA detection in swine nasal swab and oral fluid specimens using a gB-based real-time quantitative PCR. Prev Vet Med 189:105308.

# Seneca Virus A (SVA)

1. Caserta, L., J. Noll, A. Singrey, M. Niederwerder, S. Dee, E. Nelson, D. Diel. Stability of Senecavirus A in animal feed ingredients and infection following consumption of contaminated feed. 2021. Transbound Emerg Diseases. [doi.org/10.1111/tbed.14310](https://doi.org/10.1111/tbed.14310).
2. Buckley, A.C., Michael, D.D., Faaberg, K.S., Guo, B., Yoon, K., Lager, K.M. 2020. Comparison of historical and contemporary isolates of Senecavirus A. Veterinary Microbiology. 253:108946. <https://doi.org/10.1016/j.vetmic.2020.108946>.
3. Fernandes, M.H., de Lima, M., Joshi, L.R., Diel, D.G. A virulent and pathogenic infectious clone of *Senecavirus A*. *Journal of General Virology*. 2021. <https://doi.org/10.1099/jgv.0.001643>
4. Ruston C, Zhang J, Scott J, Zhang M, Graham K, Linhares D, Breuer M, Karriker L, Holtkamp D. (2021). Efficacy of Ultraviolet C exposure for inactivating Senecavirus A on experimentally contaminated surfaces commonly found on swine farms. *Veterinary Microbiology*. 256: 109040.

# Porcine Circovirus Type 2 (PCV2)

1. Rakibuzzaman, A.; Pineyro, P.; Pillatzki, A.; Ramamoorthy, S. Harnessing the genetic plasticity of PCV2 to target suicidal replication. *Viruses* 2021. 13, 1676. <https://doi.org/10.3390/v13091676>
2. Pineyro, P.; Ramamoorthy, S. Circoviridae. In *Veterinary Microbiology*, Fourth ed.; McVey, S., Kennedy, M., M.M. Chengappa, M.M., Wilkes, R., Eds. Wiley Blackwell: 2021; In Press. Invited book chapter.
3. Rakibuzzaman A, Kolyvushko O, Singh G,Nara P, Pineyro P, Leclerc E, Pillatzki A and Ramamoorthy S. Targeted alteration of antibody based immunodominance enhances the heterosubtypic immunity of PCV2 vaccines. Vaccines (Basel). 2020.Sep 4;8(3):506

# Porcine epidemic diarrhea virus (PEDV)

1. Lerner AB, Cochrane RA, Gebhardt JT, Dritz SS, Jones CK, DeRouchey JM, Tokach MD, Goodband RD, Bai J, Porter E, Anderson J, Gauger PC, Magstadt DR, Zhang J, Bass B, Karnezos T, de Rodas B, Woodworth JC. (2020). Effects of medium chain fatty acids as a mitigation or prevention strategy against porcine epidemic diarrhea virus in swine feed. *Journal of Animal Science*. 98 (6): 1-7.
2. Deng, X., Buckley, A.C., Pillatzki, A., Lager, K.M., Faaberg, K.S., Baker, S.C. 2020. Inactivating three interferon antagonists attenuates pathogenesis of an enteric coronavirus. Journal of Virology. 94(17). <https://doi.org/10.1128/JVI.00565-20>.
3. Deng, X., Buckley, A.C., Pillatzki, A., Lager, K.M., Baker, S.C., Faaberg, K.S. 2020. Development and utilization of an infectious clone for porcine deltacoronavirus strain USA/IL/2014/026. Virology. 553:35-45. <https://doi.org/10.1016/j.virol.2020.11.002>.

# SARS-CoV-2

1. Sang, E.R., Tian, Y., Gong, Y., Miller, L.C., Sang, Y. 2021. Epigenetic evolution of ACE2 and IL-6 genes as non-canonical interferon-stimulated genes correlate to COVID-19 susceptibility in vertebrates. Genes. 12(2):154. <https://doi.org/10.3390/genes12020154>.
2. Buckley, A.C., Falkenberg, S.M., Martins, M., Laverack, M., Palmer, M.V., Lager, K.M., Diego, D. 2021. Intravenous, intratracheal, and intranasal inoculation of swine with SARS-CoV-2. Viruses. 13(8). <https://doi.org/10.3390/v13081506>.

# Miscellaneous Viruses

1. Sui, C., Jiang, D., Wu, X., Liu, S., Li, F., Pan, L., Cong, X., Li, J., Yoo, D., Rock, D.L., Miller, L.C., Lee, C. 2021. Inhibition of antiviral innate immunity by Foot-and-Mouth Disease Virus Lpro through interaction with N-terminal domain of swine RNase L. Journal of Virology 95 (15) <https://doi.org/10.1128/JVI.00361-21>.
2. Buckley, A.C., Falkenberg, S.M., Palmer, M.V., Arruda, P.H., Magstadt, D.R., Schwartz, K.J., Gatto, I., Neill, J.D., Arruda, B.L. 2021. Distribution and persistence of atypical porcine pestivirus (APPV) in experimentally inoculated pigs. Journal of Veterinary Diagnostic Investigation. 33(5):952-955. <https://doi.org/10.1177/10406387211022683>.
3. Nelsen A, Lin CM, Hause BM. Porcine parvovirus 2 is predominantly associated with macrophages in porcine respiratory disease complex. 2021. Frontiers in Veterinary Science 8:726884.
4. Staton, M., Cannon, E.K., Sanderson, L., Wegrzyn, J., Buehler, S., Ficklin, S., Grau, E., Guignon, V., Gunoskey, J., Jung, S., Main, D., Poelchau, M.F., Ramnath, R., Cobo, I., Richter, P., West, J., Anderson, T.K., Inderski, B., Faaberg, K.S., Lager, K.M. 2021. Tripal, a community update after 10 years of supporting open source, standards-based genetic, genomic and breeding databases. Briefings in Bioinformatics. <https://doi.org/10.1093/bib/bbab238>.
5. Wang, L. J. Shi, and F. Blecha. 2021. Building public-private partnerships to advance global veterinary medical education: the US-China Joint DVM Program. Journal of American Veterinary medical Association. 259(3): 240-243. https://avmajournals.avma.org/doi/pdf/10.2460/javma.259.3.240
6. Madera, R., Y. Burakova, and J. Shi. 2021. “Emulsion adjuvants for use in veterinary vaccines” in Vaccine Design: Methods and Protocols, Vol. 2. Second Edition (Editor: Sunil Thomas), Methods in Molecular Biology, Humana Press.
7. DeLong RK, Swanson R, Niederwerder MC, Khanal P, Aryal S, Marasini R, Jaberi-Douraki M, Shakeri H, Mazloom R, Schneider S, Ensley S, Clarke LL, Woode RA,Young S, Rayamajhi S, Miesner T, Higginbotham ML, Lin Z, Shrestha T, Ghosh K, Glaspell G, Mathew EN. Zn-based physiometacomposite nanoparticles: distribution, tolerance, imaging, and antiviral and anticancer activity. Nanomedicine (Lond). 2021 Sep;16(21):1857-1872. doi: 10.2217/nnm-2021-0179. Epub 2021 Jul 20. PMID: 34282923.
8. Bailey Arruda, Huigang Shen, Ying Zheng, Ganwu Li. Novel Morbillivirus as putative cause of fetal death and encephalitis among swine. Emerging Infectious Diseases. 2021. July 27 (7): 1858-1866.
9. Huigang Shen, Jianfeng Zhang, Phillip C. Gauger, Eric R Burrough, Jianqiang Zhang, Karen Harmon, Leyi Wang, Ying Zheng, Thomas Petznick, Ganwu Li. Genetic characterization of porcine sapoviruses identified from pigs during a diarrhea outbreak in Iowa, 2019. Transboundary and Emerging Diseases. 2021. Mar 29. doi: 10.1111/tbed.14087.
10. Chenghuai Yang, Leyi Wang, Kent Schwartz, Eric Burrough, Jennifer Groeltz-Thrush, Qi Chen, Ying Zheng, Huigang Shen, Ganwu Li. Case Report and Genomic Characterization of a Novel Porcine Nodavirus in the United States. Viruses. 2021 Jan 7; 13(1):E73.
11. Yongming Sang, Miller LC, Nelli RK, Gimenez-Lirola LG. (2021). Harnessing Organoid Models for Virological Studies in Animals: A Cross-Species Perspective. Front Microbiol. 2021 Sep 16;12:725074. doi: 10.3389/fmicb.2021.725074. eCollection 2021.
12. Wijesena HR, Kachman SD, Lents CA, Riethoven JJ, Trenhaile-Grannemann MD, Safranski TJ, Spangler ML, Ciobanu DC. Fine mapping genetic variants associated with age at puberty and sow fertility using Sowpro90 genotyping array, J Anim Sci. 2020, September 4. doi: 10.1093/jas/skaa293.
13. Sutton K.M., C.W. Eaton, T. Borza, T.E. Burkey, B.E. Mote, J.D. Loy, D.C. Ciobanu, Genetic Diversity and Detection of Atypical Porcine Pestivirus Infections, J Anim Sci. (in press).