OIE Collaborating Centres Reports Activities

Activities in 2021

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Title of collaborating centre:	Research on Emerging Avian Diseases
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Name of writer:	David E. Swayne Laboratory Director and Supervisory Veterinary Medical Officer

ToR: To provide services to the OIE, in particular within the region, in the designated specialty, in support of the implementation of OIE policies and, where required, seek for collaboration with OIE Reference Laboratories

ToR: To identify and maintain existing expertise, in particular within its region

1. Activities as a centre of research, expertise, standardisation and dissemination of techniques within the remit of the mandate given by the OIE

Epidemiology, surveillance, risk assessment, modelling	
Title of activity	**Scope**
Avian influenza, research	H9N2 AIVs are a threat to poultry in many countries and have also caused infections in humans. In collaboration with Konkuk University, South Korea, in-depth sequence analysis of H9N2 viruses isolated between 2006 and 2016 showed that there were three separate unique introductions of viruses into the live bird markets (LNMs) of Korean domestic duck-origin and two wild aquatic bird-origin AIVs. This resulted in the generation of the five distinct types of H9N2 AIVs circulating in Korea. They also determined that the LBMs are where chickens became infected with the virus, with domestic ducks playing a major role in the transmission and evolution of the H9N2 viruses.
Avian influenza, research	A collaboration with scientists from the U.S. Geological Survey, using a combination of field- and laboratory-based determined influenza viruses shed by ducks could remain viable for extended periods in surface water within three wetland complexes of North America. The results of this study support surface waters of northern wetlands as a biologically important medium in which avian influenza viruses may be both transmitted and maintained, potentially serving as an environmental reservoir for infectious viruses during the overwintering period of migratory birds.
Avian influenza, research	A collaboration with scientists in Dominican Republic and the University of Connecticut, using whole-genome sequencing and phylogenetic analysis of nineteen H5N2 LPAIVs identified in the Dominican Republic during 2007–2019, determined the introduction of the virus from Mexico into poultry in the Dominican Republic, and divergence into three distinct genetic subgroups during 2007-2019. This information is important for understanding the epidemiology of the Mexican lineage H5N2 viruses.
Avian influenza, research	A collaboration with the University of Connecticut and the National Veterinary Service Laboratory in Ames IA, reported three detections of H7N1 LPAIV from poultry in Missouri and Texas during February and March 2018. Complete genome sequencing and comparative phylogenetic analysis suggest that the H7 LPAIV precursor viruses were circulating in wild birds in North America during the fall and winter of 2017 and spilled over into domestic poultry in Texas and Missouri independently during the spring of 2018. Wild bird origin H7 viruses have spilled over repeatedly to poultry. Given the potential to mutate into HPAIV, the present study shows how routine active surveillance in poultry and wild birds is important and necessary for monitoring and control of H5 and H7 viruses.

Newcastle disease, research	Surveillance in Kenya shows that virulent Newcastle disease is endemic in the live bird markets (LBMs) in the country. A collaborative study with Kenyan scientists demonstrated a high prevalence of virulent Newcastle disease virus in the LBMs due to the constant mixing of birds. The viruses detected were sequenced and shown to be a unique variant, V.3, that has only been found in the Kenya.
Newcastle disease, research	Studies to develop Next Generation Sequencing (NGS) as a diagnostic tool resulted in detection and sequenced of the full genomes of fowl aviadenovirus D, chicken parvoviruses, sicinivirus and infectious bronchitis virus from inactivated field materials. Having the full sequence information provides a better epidemiologic assessment of viruses circulating in poultry and improves our understanding of how co-infection of different pathogens may influence clinical disease.

Avian diseases	
Title of activity	**Scope**
Avian influenza, research	Genetic changes in four virus proteins, the PB1, NP, HA, and NA, were found to contribute to the adaptation of the H5N2 Goose/Guangdong virus from dabbling duck to chickens. This knowledge is important for understanding how H5Nx HPAI viruses spreads to poultry farms.
Avian influenza, research	An outbreak of H7N3 low pathogenicity avian influenza virus of wild bird origin occurred in commercial turkeys in North and South Carolina in April 2020 and the virus subsequently changed to the highly pathogenic form. Genetic information of the viruses determined its origin from North American wild birds and evolution of the viruses, including the change in the hemagglutinin gene that resulted in the change to be a highly pathogenic virus. A small deletion in the neuraminidase gene was identified in later turkey outbreaks which has been commonly associated with increased adaptation of the virus to chickens and turkeys.
Avian influenza, research	IN collaboration with University of Georgia, studies demonstrated that the highly pathogenic virus has higher tropism to tissues from a variety of bird species. These findings support why highly pathogenic viruses are more infectious and have a wider tissue distribution than low pathogenic viruses in experimental trials and natural disease outbreaks.
Avian influenza, research	In March 2017, H7N9 highly pathogenic (HP) and low pathogenic (LP) avian influenza virus (AIV) were detected from poultry farms and backyard birds in several states in Southeast United States. A collaboration with National Veterinary Service demonstrated virus replication and transmission of a duck LPAI isolate in chickens, with overt clinical signs of disease and shedding through both oral and cloacal routes. Genetic analysis identified numerous mutations in many gene segments and the receptor binding site in viruses recovered from chickens, indicating possible virus adaptation in the new host. Given the ability of these H7N9 viruses to readily jump between avian species, these studies demonstrate the potential of interspecies transmission on the evolution of the virus.
Avian influenza, research	Surf scoters, a large sea duck, were tested for their ability to become infected with H5Nx avian influenza viruses. Like many other ducks, surf scoters were able to become infected with the virus without becoming sick. This suggests that surf scoters, and possibly other sea ducks, could be involved in spreading avian influenza viruses over long distances.

Avian enteric virus, research	Turkey coronavirus (TCoV) can cause a highly contagious enteric disease in turkeys with severe economic losses in the global turkey industry. To establish a TCoV disease model, field strain (NC1743) of TCoV was evaluated for pathogenicity in specific-pathogen-free (SPF) turkey poults. This TCoV strain pathogenic and reproduce a typical enteric disease in day-old turkey poults with the minimal infectious dose, 6log10 EID50/birds. As the poult age increased, turkey poults became less sensitive to TCoV infection. The overall data suggest that young turkeys infected with the TCoV NC1743 strain could be used as a TCoV disease model to study the disease pathogenesis, and the minimal infectious dose of TCoV NC1743 could be used as a challenge virus to evaluate a vaccine protective efficacy.
SARS coronavirus 2	Coronaviruses (CoV) of animals periodically transmit to humans, as recently occurred with SARS-CoV-2. Because poultry are so widespread and have close contact with humans in many production systems, susceptibility studies were conducted with SARS-CoV-2, and another human coronavirus (MERS-CoV), in five common poultry species. We also tested embryonating chicken eggs (ECE) because of their importance as a laboratory host system and vaccine production. Chickens, turkeys, ducks, quail and white geese did not become infected with either virus or neither virus replicated in ECE. Based on this, poultry are unlikely to serve a role in the maintenance of either virus.
Marek’s Disease Research	Joint selection in chickens for genetic resistance to symptoms and reduced feather viral load could be effective in reducing Marek’s disease. A focus on selecting host genomic variants affecting viral replication and load would represent a rapid and efficient means to increase flock-level protection through promoting both increased resistance and reduced infectivity.

Diagnosis, biotechnology and laboratory

Title of activity	Scope
Avian influenza, research	Identification of optimal sample collection for the detection of virus in the environment was to moisten 4-inch squares of cotton gauze and wipe areas of the coop that the chicken could touch. Using the most sensitive and efficient virus detection method helps to re-open farms after an outbreak by ensuring that poultry can be re-stocked safely, giving confidence to customers and trade partners that the threat of virus resurgence is minimized or even eliminated.

Vaccines

Title of activity	Scope
Avian influenza, research	Two US-origin, non-virulent H7 strains inducing a strong immune response in chickens were identified as good vaccine candidates for protection against contemporary North American H7 avian influenza viruses.
Avian influenza, research	In studies that simulated avian influenza virus infection in vaccinated chickens by using embryonating chicken eggs, it took 20-30 generations for the virus to change antigenically, and if the vaccine induced immunity could compensate for the changes if given at higher doses. This information provides guidelines to establish adequate vaccine doses, improving the vaccination process as the antigenic distance increases between vaccine and field viruses.

Avian influenza, research	Experimental herpesvirus of turkey (vHVT) vectored vaccines containing COBRA insert clade 2.3.4.4A-derived H5 inserts provided broader protection against mortality and decreased virus shedding from diverse H5Nx HPAI challenge viruses. The wild-type-derived H5 vaccines elicited protection mostly against close antigenically viruses, while the COBRA-derived vaccines elicited antibody responses against antigenically diverse strains, which could be used to protect against future avian influenza variants.
Avian influenza, research	A collaboration with Bangladesh Livestock Research Institute, University of Connecticut and the Food and Agricultural Organization reported good protection in chickens for an inactivated H5 vaccine and a recombinant herpesvirus of turkey's vaccine with an H5 insert for protection in chickens against most recent H5N1 2.3.2.1 highly pathogenic avian influenza field viruses. However, one field virus obtained from a crow was an antigenic outlier and HPAI viruses in crows should be continually examined for emergence of vaccine resistance
Newcastle disease, research	The use of live virus-vectored vaccines for Newcastle disease virus and other pathogens is increasing in poultry because of proven protection and reduced vaccine reactions. An adenovirus expressing the fusion protein of Newcastle disease virus, demonstrated that the immune response to the fusion protein was effective by itself and that matching the sequence of the vaccine to the challenge virus provided better protection. Previous studies have shown that whole virus vaccines, either live or inactivated, had better protection when the vaccines were closely matched to the challenge strain. This study provides evidence that matching just part of the virus, the fusion protein, also has better protection when matched to the challenge virus. Most commercial vaccines use genotype 1 or 2 Newcastle disease viruses, but virulent circulating strains are other genotypes that differ in sequence by 10-20% and current vaccines are not providing optimal immunity. This study shows the adenovirus system to be a useful vaccine vector and that matching the vaccine to the challenge virus, even with sub-unit vaccines will provide the best protection.
Marek's disease, research	Deletion of thymidine kinase from Marek's disease virus (MDV) vaccine candidate reduced replication of the live-attenuated vaccine and resulted in the elimination of residual virulence. This change also reduced protection, which suggests that lowering vaccine replication may be an unsuitable method for improving vaccine candidates while maintaining superior protection.
Marek's disease, research	The genome of an MD vaccine strains (301B/1) was modified to express an immunostimulating factor (interleukin-15, IL-15) which did not hamper the recombinant's replicative capacity in cultured cells. This recombinant was genetically stable after serial passage which supports opportunities for vaccinal efficacy in animal studies.

ToR : To propose or develop methods and procedures that facilitate harmonisation of international standards and guidelines applicable to the designated specialty

2. Proposal or development of any procedure that will facilitate harmonisation of international regulations applicable to the surveillance and control of animal diseases, food safety or animal welfare

Proposal title	Scope/Content	Applicable area

RRT-PCR specific test for detection of Newcastle disease fusion protein cleavage site	A sensitive and specific RRT-PCR test to identify all Newcastle disease virus genotypes based fusion protein cleavage site	☒Surveillance and control of animal diseases ☐Food safety ☐Animal welfare

ToR: To establish and maintain a network with other OIE Collaborating Centres designated for the same specialty, and should the need arise, with Collaborating Centres in other disciplines

ToR: To carry out and/or coordinate scientific and technical studies in collaboration with other centres, laboratories or organisations

3. Did your Collaborating Centre maintain a network with other OIE Collaborating Centres (CC), Reference Laboratories (RL), or organisations designated for the same specialty, to coordinate scientific and technical studies?

Yes

Name of OIE CC/RL/other organisation(s)	Location	Region of networking Centre	Purpose
National Reference Laboratory for Avian Influenza	BANGLADESH	☐Africa ☐Americas ☒Asia and Pacific ☐Europe ☐Middle East	Assessing genetic and antigenic drift of H5N1 high pathogenicity avian influenza viruses in comparison to vaccines used in the field
Roslin Institute at the University of Edinburgh	UNITED KINGDOM	☐Africa ☐Americas ☐Asia and Pacific ☒Europe ☐Middle East	Evolution of Avian Influenza Virus.
Sokoine University of Agriculture	TANZANIA	☒Africa ☐Americas ☐Asia and Pacific ☐Europe ☐Middle East	Diagnostic testing of chicken samples from live bird markets from Tanzania
Kenya Agricultural and Livestock Research Organization	KENYA	☒Africa ☐Americas ☐Asia and Pacific ☐Europe ☐Middle East	Collaboration on active surveillance in chickens and passive surveillance in chickens, pigeons and wild species of birds to determine avian influenza viral distribution, and identification of ecological correlates in Kenya, and to develop a training program on genomic characterization, sequencing, and bioinformatics.

University of Georgia	USA	☐Africa ☒Americas ☐Asia and Pacific ☐Europe ☐Middle East	Development of Modified Live vaccines for protection of poultry against high and low pathogenic avian influenza virus
Avian influenza laboratory, Avian Diseases Division; OIE Reference Labs for Highly pathogenic avian influenza and low pathogenic avian influenza (poultry)	Dominican Republic and USA	☐Africa ☒Americas ☐Asia and Pacific ☐Europe ☐Middle East	Modelling of H5N2 low pathogenic avian influenza virus epidemiology

4. Did your Collaborating Centre maintain a network with other OIE Collaborating Centres, Reference laboratories, or organisations <u>in other disciplines</u>, to coordinate scientific and technical studies?

No

ToR: To place expert consultants at the disposal of the OIE.

5. Did your Collaborating Centre place expert consultants at the disposal of the OIE?

Yes

Name of expert	Kind of consultancy	Subject
David E Swayne	Scientific	OIE ad hoc Avian Influenza Chapter Committee, Terrestrial Animal Health Code
David E. Swayne	Scientific	OFFLU ad hoc Avian Influenza Chapter Committee, Terrestrial Animal Health Manual
David E Swayne, Erica Spackman, and David L. Suarez	Scientific	OFFLU network expertise on Avian influenza; and OFFLU Avian Influenza, and Wildlife Technical Activities

ToR: To provide, within the designated specialty, scientific and technical training to personnel from OIE Member Countries

6. Did your Collaborating Centre provide scientific and technical training, within the remit of the mandate given by the OIE, to personnel from OIE Member Countries?

Yes
a) Technical visits: 0

b) Seminars: 0
c) Hands-on training courses: 0
d) Internships (>1 month): 8

Type of technical training provided (a, b, c or d)	Content	Country of origin of the expert(s) provided with training	No. participants from the corresponding country
d	Learn the molecular biology techniques and get training in reverse genetics technology, conduct research on enteric viral diseases of poultry and develop an enterotropic Newcastle disease virus (NDV) vaccine strain- based live recombinant vaccine against an enteric viral disease and NDV	South Korea (1), Egypt (2)	3
d	Diagnosis, epidemiology, control (including vaccines) and pathobiology of Newcastle Disease, Avian Influenza and Marek’s Disease	South Korea (2), Kenya (1), Nigeria (1) , Philippines (1),	5

ToR: To organise and participate in scientific meetings and other activities on behalf of the OIE

7. Did your Collaborating Centre organise or participate in the organisation of scientific meetings on behalf of the OIE?

No

ToR: To collect, process, analyse, publish and disseminate data and information relevant to the designated specialty

8. Publication and dissemination of any information within the remit of the mandate given by the OIE that may be useful to Member Countries of the OIE

a) Articles published in peer-reviewed journals: 39
1. Bertran, K., Kassa, A., Criado, M.F., Lee, D.H., Killmaster, L., Sá e Silva, M., Ross, T., Mebatsion, T., Pritchard, N., Swayne, D.E. 2021. Efficacy of recombinant Marek’s disease virus vectored vaccines with computationally optimized broadly reactive antigen (COBRA) hemagglutinin insert against genetically diverse H5 high pathogenicity avian influenza viruses. Vaccine 39(14):1933-1942. https://doi.org/10.1016/j.vaccine.2021.02.075
2. Bonney, P., Malladi, S., Ssematimba, A., Spackman, E., Torchetti, M., Culhane, M., Cardona, C. 2021. Estimating epidemiological parameters using diagnostic testing data from low pathogenicity avian influenza infected turkey houses. Scientific Reports. 11:1-10. https://doi.org/10.1038/s41598-021-81254-z.
3. Brown C, Zhang J, Pantin-Jackwood M, Dimitrov K, Ferreira HL, Suarez D. In situ cytokine gene expression in early stage of virulent Newcastle disease in chickens. Vet Pathol. 2022 Jan;59(1):75-81. doi: 10.1177/03009858211045945.
4. Chuard, A., Courvoisier-Guyader, K., Remy, S., Spatz, S.J., Denesvre, C., Pasdeloup, D. 2020. The tegument protein pUL47 of Marek’s disease virus is necessary for horizontal transmission and is important for expression of glycoprotein gC. Journal of Virology. 95(2):1-19. https://doi.org/10.1128/JVI.01645-20.
5. Conrad, S.J., Hearn, C.J., Silva, R.F., Dunn, J.R. 2020. Codon deoptimization of UL54 in meq-deleted Marek's disease vaccine candidate eliminates lymphoid atrophy but reduces vaccinal protection. Avian Diseases. 64(3):243-246. https://doi.org/10.1637/aviandiseases-D-19-00166.

6. Criado, M.F., Moresco, K.A., Stallknecht, D.E., Swayne, D.E. Low pathogenicity influenza viruses replicate differently in laughing gulls and mallards. Influenza and Other Respiratory Viruses 15(6):701-706, 2021. DOI: 10.1111/irv.12878.
7. Criado, M.F., Leyson, C., Youk, S., DeBlois, S., Olivier, T., Killian, M.L., Torchetti, M.L., Parris, D.J. Spackman, E., Kapczynski, D.R., Suarez, D.L., Swayne, D.E., Pantin-Jackwood, M.J. The pathobiology of H7N3 low and high pathogenicity avian influenza viruses from the United States outbreak in 2020 differs between turkeys and chickens. Viruses 2021, 13, 1851. DOI 10.3390/v13091851.
8. Dimitrov, K.M. Taylor, T.L., Marcano, V.C., Williams-Coplin, D., Olivier, T.L., Yu, Q., Gogal, R.M., Jr., Suarez, D.L., Afonso, C.L. Novel Recombinant Newcastle Disease Virus-Based In Ovo Vaccines Bypass Maternal Immunity to Provide Full Protection from Early Virulent Challenge. Vaccines, 2021, 9, 1189. https://doi.org/10.3390/vaccines9101189.
9. Dunn, J.R., Mays, J.K., Hearn, C.J., Hartman, A. 2021. Comparison of Marek's disease virus challenge strains and bird types for vaccine licensing. Avian Diseases. 65 (2):241-249. https://doi.org/10.1637/aviandiseases-D-20-00122.
10. Ferreira, H.L., Miller, P.J., Suarez, D.L. 2021. Protection against different genotypes of Newcastle disease viruses (NDV) afforded by an adenovirus-vectored fusion protein and live NDV vaccines. Vaccines. 9(2):182. https://doi.org/10.3390/vaccines9020182
11. Glass, M.C., Smith, J.M., Cheng, H.H., Delany, M.E. 2021. Marek’s disease virus telomeric integration profiles of neoplastic host tissues reveal unbiased chromosomal selection and loss of cellular diversity during tumorigenesis. Genes. 12(10):1630. https://doi.org/10.3390/genes12101630
12. Goraichuk, I.V., Davis, J.F., Kulkarni, A.B., Afonso, C.L., Suarez, D.L. 2021. A 24-year-old sample contributes the complete genome sequence of fowl aviadenovirus D from the United States. Microbiology Resource Announcements. 10:(1):e01211-20. https://doi.org/10.1128/MRA.01211-20.
13. Goraichuk, I.V., Davis, J.F., Kulkarni, A.B., Afonso, C.L., Suarez, D.L. 2021. Whole-genome sequence of avian Coronavirus from a preserved 15-year-old sample confirms evidence of GA08 strain circulation 4 years prior to its first reported outbreak. Microbiology Resource Announcements. 10/15:e01460-20. https://doi.org/10.1128/MRA.
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15. Hauck, R., Mays, J.K., Dunn, J.R., Shivaprasad, H.L. 2020. Two cases of Marek's disease in backyard turkeys. Avian Diseases. 64(3):347-351. https://doi.org/10.1637/aviandiseases-D-19-00177.
16. Heidari, M., Zhang, H., Hearn, C.J., Sunkara, L. 2021. B cells do not play a role in vaccine-mediated immunity against Marek's disease. Vaccine. 10:100128. https://doi.org/10.1016/j.jvacx.2021.100128
17. Hein, R., Koopman, R., Garcia, M., Armour, N., Dunn, J.R., Barbosa, T., Martinez, A. 2021. Review of poultry recombinant vector vaccines. Avian Diseases. 65 (3): 438–452. https://doi.org/10.1637/0005-2086-65.3.438.
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19. Jerry C, Stallknecht DE, Leyson C, Berghaus R, Jordan B, Pantin-Jackwood M, França MS. Age-Associated Changes in Recombinant H5 Highly Pathogenic and Low Pathogenic Avian Influenza Hemagglutinin Tissue Binding in Domestic Poultry Species. Animals (Basel). 2021 Jul 28;11(8):2223. doi: 10.3390/ani11082223.
20. Kang, K., Day, J.M., Eldemery, F., and Yu, Q. Pathogenic evaluation of a turkey coronavirus isolate (TCoV NC1743) in turkey poults for establishing a TCoV disease model. Veterinary Microbiology, 2021 Jun 18;259:109155. DOI: 10.1016/j.vetmic.2021.109155.
21. Karithi, H.M., Ferreira, H.L., Welch, C.N., Ateya, L.O., Apopo, A.A., Zoller, R.W., Volkening, J.D., Williams Coplin, T.D., Parris, D.J., Olivier, T.L., Goldenberg, D., Yatinder, B.S., Hernandez, S.M., Afonso, C.L., Suarez, D.L. 2021. Surveillance and genetic characterization of virulent Newcastle disease virus subgenotype V.3 in indigenous chickens from backyard poultry farms and live bird markets in Kenya. Viruses. 13(1):103. https://doi.org/10.3390/v13010103.
22. Kern, C., Ying, W., Xu, X., Pan, Z., Halstead, M., Chanthavixay, G., Saelao, P., Waters, S., Xiang, R., Chamberlain, A., Korf, I., Delany, M.E., Cheng, H.H., Medrano, J.F., Van Eenennaam, A.L., Tuggle, C.K., Ernst, C., Flicek, P., Quon, G., Ross, P., Zhou, H. 2021. Functional annotations of three domestic animal genomes provide vital resources for comparative and agricultural research. Nature Communications. 12:1821. https://doi.org/10.1038/s41467-021-22100-8.
23. Khalid, Z., He, L., Yu, Q., Breedlove, C., Joiner, K., Toro, H. 2021. Enhanced Protection by Recombinant Newcastle Disease Virus Expressing Infectious Bronchitis Virus Spike Ectodomain and Chicken Granulocyte-Macrophage Colony-Stimulating Factor. Avian Diseases. 65(3): 364–372. https://doi.org/10.1637/aviandiseases-D-21-00032.
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39. Yuan, Y., Zhang, H., Yi, G., You, Z., Zhao, C., Yuan, H., Wang, K., Li, J., Yang, N., Lian, L. 2021. Genetic diversity of MHC-BF/BL region in 21 chicken populations. Frontiers in Genetics. 12:710770. https://doi.org/10.3389/fgene.2021.710770.

b) International conferences: 5

1. He, L. Recombinant Newcastle Disease Virus (rNDV) Expressing a Marek’s Disease Virus (MDV) Immunogen Protects Chickens Against MDV and NDV Challenges. Presented in “The 13th International Symposium on Marek's Disease and Avian Herpesviruses”. Virtual from Guelph, ON, Canada. June 1-3, 2021.
2. Leyson, C. Whole genome sequencing of H7N3 avian influenza viruses from infected turkeys and chickens reveal differences in within-host virus population diversities, 50th Philippine Society for Microbiology Annual Scientific Virtual meeting on July 21-24, 2021.
3. Pantin-Jackwood, M. Experimental co-infection studies with respiratory viruses and Mycoplasma synoviae in chickens and turkeys. Virtual 14th Annual Congress of Asociación Nacional De Especialistas En Ciencias Avícolas De México (ANECA) (ie Mexican Poultry Health Association), Mexico, 27-30 April, 2021.
4. Swayne, D.E., “Current situation of avian influenza and challenges for the global poultry industry”, Virtual 14th Annual Congress of Asociación Nacional De Especialistas En Ciencias Avícolas De México (ANECA) (ie Mexican Poultry Health Association), 29 April 2021

5. Swayne, D.E., “The Process for Assessing H5 Poultry Vaccine Protection Against Emergent Field Viruses in Bangladesh,” Virtual 27th Annual Meeting of the European Union National Reference Laboratories for Avian Influenza and Newcastle Disease, 6-7 October 2021

c) National conferences: 27
1. Chuard, A., Courvoisier-Guyader, K., Remy, S. Spatz, S., Denesvre, C. and Pasdelop, D. Molecular basis for the role of the tegument protein pUL47 of Marek’s disease virus in horizontal transmission. 45th annual international herpesvirus workshop, Virtual meeting on August 2-6.
2. Eldemery, F., Ou, C., Kim, T., Spatz, S., Dunn, J., Silva, R., and Yu, Q. Attenuation of NDV LaSota strain by codon pair deoptimization of the HN and F genes for in ovo vaccination. The 40th Annual Meeting of American Society for Virology, Virtual meeting on July 19 - 23, 2021.
3. He, L., Spatz, S., Dunn, J., Yu. Newcastle disease virus (NDV) recombinant expressing a Marek’s disease virus (MDV) immunogen protects chickens against MDV and NDV challenges. The 13th international symposium on Marek’s disease and avian herpesviruses, Virtual meeting on June 1-3, 2021.
4. He, L., Zhang, Z., and Yu, Q. Newcastle disease virus recombinant expressing two foreign genes from the optimal insertion sites for use as a multivalent vaccine vector. The 40th Annual Meeting of American Society for Virology, Virtual meeting on July 19 - 23, 2021.
5. Kim, T., Dunn, J., Reddy, S., and Spatz, S. Pathogenicity of very virulent plus Marek’s disease virus with modified virulence associated genes. S. The 13th international symposium on Marek’s disease and avian herpesviruses, Virtual meeting on June 1-3, 2021.
6. Leyson, C., Criado, M., Youk, S., Suarez, D.L., Swayne, D.E. and Pantin-Jackwood, M. Infectivity, transmission, and genomic changes in turkeys and chickens infected with low and highly pathogenic H7N3 avian influenza viruses from the turkey farm outbreaks in North and South Carolina in 2020. International Poultry Scientific Forum (IPSF) Virtual Conference January 25-26th, 2021.
7. Leyson, C., Criado, M., Youk, S., Suarez, D.L., Swayne, D.E. and Pantin-Jackwood, M. Within-host diversity of 2020 H7N3 avian influenza viruses in turkeys and chickens. American Society for Virology Virtual meeting on July 19 - 23, 2021
8. Leyson, C., Criado, M., Youk, S., Suarez, D.L., Swayne, D.E. and Pantin-Jackwood, M. Genotypic changes in low pathogenicity avian influenza viruses after replication in chickens and turkeys. American Association of Avian Pathologists Annual Meeting, Minneapolis, MN, July 30-August 3, 2021
9. Mo, J., Evaluation of the Pathogenesis and Transmission of Live Bird Market H2N2 avian influenza viruses in Chickens, Pekin ducks, and Guinea fowl, Southern Conference on Avian Diseases 2021, 25-26 January 2021
10. Mo, J. Characterization of the Thermal Inactivation Profile of Newcastle Disease Virus in Poultry Litter, American Association of Avian Pathologists, 2021 Annual Meeting, 30 July-3 Aug 2021
11. Pantin-Jackwood, M., Youk, S., Leyson, C., Suarez D.L. Adaptation of Mexican lineage H5N2 low pathogenic avian influenza virus in chickens. American Association of Avian Pathologists Annual Meeting, Minneapolis, MN, July 30-August 3, 2021
12. Pantin-Jackwood, M. Infectivity of contemporary HPAI viruses among waterfowl hosts. 2021 Webinar Series: Highly pathogenic avian influenza and wild birds. USGA Alaska Science Center, August 1-4, 2021.
13. Spackman., E. Lack of detection of airborne surrogate agents for highly pathogenic avian influenza virus in on-farm composting studies of carcasses with simulated contamination. 6th International Biosafety & Biocontainment Virtual Symposium, 2-4 February 2021
14. Spackman, E., Luczo, J. “Characterizing the Antigenic Evolution of North American H9N2 Avian Influenza Viruses,” American Association of Avian Pathologists 2021 Annual Meeting, 30 July-3 Aug 2021
15. Spatz, S., Garcia, M., Fuchs, W., and Kim, T. Reconstruction and mutagenesis of avian infectious laryngotracheitis virus from cosmid and yeast centromeric plasmids clones. The 13th international symposium on Marek’s disease and avian herpesviruses, Virtual meeting on June 1-3, 2021.
16. Spatz, S. and Kim, T. Isomerization of Gallid alphaherpesvirus genome. 45th annual international herpesvirus workshop, Virtual meeting on August 2-6.
17. Suarez, David L. Experimental Studies with H2N2 LPAIVs isolated from Live Bird Markets in the U.S. APHIS Live Bird Market Working Group Virtual Meeting February 18, 2021.
18. Suarez, David L., SARS CoV-2 and it’s Impact on Agriculture, 64th Annual Biosafety and Biosecurity Virtual Conference, October 27, 2021.
19. Swayne, D.E., Emergency Response Research, Session on Emergency Response and Research, Virtual National Bio- and Agro-Defense Facility Scientific Symposium, 30 April 2021.
20. Swayne, D.E., Virtual Panel Discussion on Influenza Vaccines, 21st World Vaccine Congress, Washington DC, 4-6 May 2021
21. Swayne, D.E., U.S. National Poultry Research Center (USNPRC) Support in Avian Health and Commodities Trade for the US Poultry Industries, USA Poultry and Egg Export Council, Nashville, TN, 23-24 June 2021
22. Swayne, D.E., Emerging Poultry Disease Concerns, 2021 Affiliated State Poultry Association Executives Workshop, U.S Poultry and Egg Association, Tucker, GA, 28 July 2021
23. Swayne, D.E., Impact of Highly Pathogenic Avian Influenza and Other Exotic Diseases on Global Poultry

Health, Poultry Health and Grow-out Committee (Virtual), National Chicken Council, 27 September 2021
24. Swayne, D.E., Emerging Poultry Disease Concerns, Animal Health and Biosecurity Committee Meeting, 2021 Annual Board Meeting & Executive Conference, United Egg Producers, Amelia Island, Florida, 26-29 October 2021
25. Swayne, D.E., A Paradigm Shift in the Use of Vaccines and Vaccination in Global Control of Avian Influenza, US Animal Vaccinology Research Coordination Network at the Conference of Research Workers in Animal Disease (CRWAD) Conference, Chicago, Illinois, 5 December 2021
26. Youk, S., Leyson, C., Pantin-Jackwood, M. Identification and comparison of genetic changes associated with poultry adaptation of wild bird origin North American H7 subtype avian influenza viruses. International Poultry Scientific Forum (IPSF) Virtual Conference January 25-26th, 2021.
27. Youk, S., Leyson, C., Pantin-Jackwood, M Molecular changes in the Hemagglutinin gene of North American lineage H7 subtype avian influenza viruses in incursions from wild birds into poultry. American Association of Avian Pathologists Annual Meeting, Minneapolis, MN, July 30-August 3, 2021

d) Other
(Provide website address or link to appropriate information): 0

9. Additional comments regarding your report: