**Appendix D**

**NC1029 Accomplishments Report**

**Project Number:** NC1029

**Project Title:** Applied Animal Behavior and Welfare

**Period Covered:** 10/1/2020 to 10/1/2022

**Date of Report:** 11/28/2022

**Annual Meeting Date:** 9/30/2022

**Participants:** USDA-NIFA: Hamilton; Auburn University: Baker-Cook, Bourassa; Texas A&M University: Leatherwood, Daigle; University of Wisconsin – Madison: VanOs, Adcock; University of Wisconsin – River Falls: Creutzinger; Oregon State University: Udell; University of Florida: Miller-Cushion, Wickens; Clemson University: Ahmed, Jones; Texas Tech University: Anderson; University of Minnesota: Endres; University of Arkansas: Weimer; University of California – Davis: Makagon, Tucker, Blatchford, Gross, Moddy, Horback; University of Kentucky: Costa; Virginia Tech University: Jacobs; University of Nebraska – Lincoln: Desauliners; Iowa State University: Johnson, Millman

**Brief Summary of Minutes of Annual Meeting**

* **Welcome, agenda review, NIFA announcements:** there were 29 participants from 16 stations. Meeting goals were announced, which were updates on NIFA administration (document shared) and all members, to identify collaborations among institutions.
* **Administrative update:** Christina Hamilton discussed the structure of multistate groups and fielded questions from members.
* **Station reports:** Group members provided summaries of NC1029-pertinent research they have conducted in the past year as well as announcements on new facilities, faculty members, and hiring positions.
* **Project editor elections:** New secretary was elected.

**Accomplishments**

For Objective 1, novel indicators of animal welfare, NC1029 generated new knowledge about XXX. This is relevant because XXX.

For Objective 2, Generating new information to inform animal welfare assessment programs, NC1029 generated practical, farmer accessible information about XXXX.

**Outputs:** see Publications

**Impact Statement Summaries**

Animal welfare is affected by a multitude of dynamic, fluctuating physiological and external environments. The effect of several of these factors on animal welfare are well known, yet limited scientific evidence exists in some areas more than others.

**Development of outcome-based measurements for welfare assessments.** Research efforts were targeted to develop novel welfare assessment criteria (e.g., behavior, resource use) and strengthen the scientific support of currently utilized welfare assessment tools or housing recommendations (e.g., stocking density).

**Development of cognitive bias testing evaluation strategies**. Emotional (affective) states are difficult to quantify and can range from negative, to neutral, to positive. Research efforts have been deployed to develop strategies for cognitive bias testing methodology for poultry, especially broiler chickens, and swine.

**Quantifying behaviors indicative of stress, disease, pain, and aggression.** Members are generating knowledge on the gastrointestinal physiology of horses with a history of oral stereotypic behavior and sheep attachment and stress related behavior. Changes in genomic markers and social behavior are an indicator of welfare (disease/pain) in dairy calves as well as group-housing aggression and heat stress in pigs.

**Impact of environment and management practices on animal welfare.** Members are evaluating the effect of environment (lighting and environmental enrichment) on swine welfare in farrowing stalls, the role of enrichment on poultry, cattle, and goat welfare, and the benefits of exercising horses at a young age.

**Euthanasia research is important to ensure animals are killed humanely.** Research evaluating behavioral and physiological indicators of poultry welfare during cervical dislocation and stunning and has indicated that decapatation during cervical dislocation does not impact broiler welfare during euthanasia and that stress hormones do not exhibit the same response patterns during electrical and carbon dioxed controlled atmsphereic stunning methods.

**The use of precision livestock tools is ubiquitous throughout the membership.** Precision livestock farming is the future of animal agriculture and is critical to monitoring animal welfare and promoting sustainability. Long-term goals are to create evidence-based recommendations for the sustainable use of precision technologies for horse therapy programs and on dairy farms, with focuses on improving animal welfare assessment and individual animal management on-farm using precision technology data. Specific projects emphasizing precision technology investigated the economics of dairy calf raising and benchmarking tools at the farm level. Decision support tools will help dairy farmers understand decision economics and make more informed decisions toward improved profitability. Technology research provides new insight into the utility of automated temperature monitoring. Decision support tools will help dairy farmers understand decision economics and make more informed decisions toward improved profitability. Finally, good animal welfare is paramount to the dairy industry, including producers, processors, distributors, and cooperatives. The development of a new, accurate, and remote welfare assessment benchmark using validated multi-variable precision dairy technologies (PDTs) has the potential to increase the sustainability of the dairy industry. **Publications, NC1029 members are bolded**

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**Chapel, N.M.**, J. M. Young, and S. Wagner. 2020. The effects of flunixin meglumine and hoof trimming on lying behavior and locomotion in lactating dairy cows. Journal of Dairy Science. 103(6): 5422-5430.

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**Conference Papers, posters, and oral presentations**

Rudd, C., E. Pasiuk, K. Schroeder, **N. Anderson**, and N. Hall. Fake It ‘til You Make It: A Preliminary Exploration of Congruence Between Physiology and Behavior in Horses During Horse-Human Interactions. International Society of Equitation Science. Hartpury, UK. August 9, 2022. Oral presentation.

Rudd, C., E. Pasiuk, K. Schroeder, **N. Anderson**, and N. Hall. A psychobiological approach to promoting low-stress interactions in Equine-Assisted Services. International Society of Anthrozoology. Boise, Idaho. July 7-9, 2022. Oral presentation.

Baxley, B. H. and **N. C. Anderson**.Assessment of Equine Acclimation to New Management Using Non-invasive Metrics. American Society of Animal Sciences. Oklahoma City, Oklahoma. June 27-30, 2022. Poster presentation.

Rudd, C., E. Pasiuk, K. Schroeder, **N. Anderson**, and N. Hall. Equine Stress Levels During Stationary and Mobile Activities Used in Equine-Assisted Services. Graduate Student Research Poster Competition. Lubbock, Texas. March 3, 2022. Poster presentation.

McLoda, S., **N. Anderson**, and D. Lugar. Affect of light regiment on farrowing performance in sows. American Society of Animal Sciences, Midwest Section. March 8-10, 2021. Poster presentation.

**Croney, C, JSwanson**. 2022. Is meat eating morally defensible? Contemporary ethical considerations. The Societal Role of Meat: An International Summit. Dublin, Ireland. October 19-20, 2022.(talk)

**Daigle, C**. X Meneses, **J Swanson.** 2021 Optimizing animal welfare in a socially acceptable and sustainable manner: The ASAS Grand Challenge that requires moral self-reflection and scientific calibration. ASAS Public Policy Symposium. Proceedings of the American Society of Animal Science Annual Meeting, Louisville KY.(talk)

Grebey T, **Swanson J,** Widowski T, **Siegford J.** 2021. Daily morning litter restriction: variation in dust bathing patterns among 4 genetic strains of laying hen. Proceedings of the 54th Congress of the International Society for Applied Ethology. 54:93. (talk)

Grebey T, Han J, Steibel J, **Siegford J.** 2022. Measuring the amount of vertical space needed for laying hens to flap their wings. Proceedings of the 14th ISAE North-American Regional Meeting. 14:64. (talk)

Olmos Antillón, G, H Tunón, D De Oliveira, M Jones,A Wallenbeck, **J Swanson**, H Blokhuis, L Keeling. 2021. Broadening students’ perspectives -Animal Welfare and UN's Sustainable Development Goals. Proceedings of Welfare at the Farm and Group Level. (talk)

Rentsch A, Harlander A, Niel L, **Siegford J**, Widowski T. 2021. Effect of brooding compartment design on physical abilities of laying hen chicks. Proceedings of the 54th Congress of the International Society for Applied Ethology. 54:134. (talk)

Rentsch AK, Niel L, **Siegford J**, Widowski T. 2021. Rearing aviary design and genetic strain affect spatial cognition in laying hen pullets. Poultry Science. 100(E-supplement 1):10. (talk)

Rentsch AK, Harlander A, Niel L, **Siegford J**, Widowski T. 2022. Early life environment and genetic strain are key for the development of locomotion skills in laying hens. Proceedings of the 2022 World Poultry Congress. (talk)

Rentsch AK, Niel L, **Siegford J**, Widowski T. 2022. Spatial skills of 3-week-old laying hen chicks are affected by flock, housing, and genetic strain. Proceedings of the 14th ISAE North-American Regional Meeting. 14:19. (poster)

**Siegford J**, Steibel J, Han J, Benjamin M, Brown-Brandl T, Dorea JRR, Morris D, Norton T, Psota E, Rosa GJ. 2022. The quest to develop automated systems for monitoring animal behaviour. Proceedings of the 55th Congress of the International Society for Applied Ethology. 55:3. (plenary talk)

**Swanson, J.** 2022. What we do and don’t know related to cage-free production research. Proceedings of the Midwest Poultry Convention, Minneapolis, MN.(talk)

**Swanson, J**,D Buskirk. Host. 6th International Symposium on Beef Cattle Welfare Webinar Series. February –June 2022. 5 -2 hr. monthly webinars. <https://www.canr.msu.edu/beefwelfare2022/>

Toscano M,**Siegford J.** 2021. The importance of ramp usage for pullet and layer health and production.Egg Industry Issues Forum (virtual), Egg Industry Center, Ames, IA, April 20-22, 2021. (virtual talk)

**Adcock, Sarah**, Blair Downey, **Cassandra Tucker**. 2022. Behavioural changes in the first 3weeks after disbudding in dairy calves. International Society for Applied Ethology Congress. Ohrid, North Macedonia.

Wudi, Sam, Jocelyn M. Woods, **Sarah J.J. Adcock**.2022.A machine learning approach to classifying lying behavior in sheep. Animal Behavior Society Conference. San Jose, Costa Rica.

Woods, Jocelyn M., **Sarah J.J. Adcock**.2022. Validation of a real-time location system to monitor sheep movement. Animal Behavior Society Conference.San Jose, Costa Rica.

Reuscher, K.J., N.B. Cook, M.R. Mondaca, and **J.M.C. Van Os**. 2022. Effects of airspeed from fans located above the freestalls on heat stress responses. Dairy Cattle Welfare Symposium. Syracuse, NY.

Drwencke, Alycia M., **Sarah J.J.Adcock, Cassandra B. Tucker**. 2022. Wound healing and sensitivity following caustic paste disbudding in dairy calves. Dairy Cattle Welfare Symposium.Syracuse, NY.

da Silva, T, **J. Van Os**, K. Reed, V. Cabrera, N. Cook. 2022. Lameness and its impacts on dairy herds: The welfare sub-module in the Ruminant Farm Systems model. 18th International Conference on Production Diseases in Farm Animals. Madison, WI.

Reuscher, K.J., N.B. Cook, M.R. Mondaca, and **J.M.C. Van Os.** 2022. Effects of airspeed from fans located above freestalls on heat stress responses. North American regional meeting of the ISAE. Davis, CA.

Drwencke, Alycia M., **Sarah J.J. Adcock, Cassandra B. Tucker.** 2022.Wound healing following caustic paste disbudding in dairy calves. North American regional meeting of the ISAE. Davis, CA.

Reyes, Faith S., Amanda R. Gimenez, Kaylee M. Anderson, **Emily K. Miller-Cushon**, Joao R. Dorea, and **Jennifer M.C. Van Os**. 2022. Impact of stationary brush quantity on brush use in group-housed dairy heifers.North American regional meeting of the ISAE. Davis, CA.

Silva, Fernanda M., **Jennifer M.C. Van Os**, Charlotte Winder, Matthew Akins, Tina Kohlman, Theresa Ollivett, Heather Schlesser, Becky Schley, Sandra Stuttgen, and Jim Versweyveld. 2022. Veterinarian-opinions on calf housing and management. Annual Meeting of the ADSA. Kansas City, MO.

Silva, Fernanda M., **Jennifer M.C. Van Os**, Charlotte Winder, Matthew Akins, Tina Kohlman, Theresa Ollivett, Heather Schlesser, Becky Schley, Sandra Stuttgen, and Jim Versweyveld. 2022. Veterinarian’s disbudding practices and perceptions. Annual Meeting of the ADSA. Kansas City, MO.

Reuscher, K.J., N.B. Cook, C. Halbach, M.R. Mondaca, and **J.M.C. Van Os.** 2022. Assessing heat abatement on 12 Wisconsin dairy facilities. Annual Meeting of the ADSA. Kansas City, MO.

Reuscher, K.J., R. Salter, and **J.M.C. Van Os**. 2022. Interactions of cold stress and social contact in outdoor-housed dairy calves. Annual Meeting of the ADSA. Kansas City, MO.

Reyes, Faith S., Sophia J. Erb, Kent A. Weigel, Heather M. White, and **Jennifer M.C. Van Os**. 2022. Relationships of feeding behavior and feed efficiency in same-and mixed-parity groups of dairy cows. Annual Meeting of the ADSA. Kansas City, MO.

Reyes, Faith S., Sophia J. Erb, Kent A. Weigel, HeatherM. White, and **Jennifer M.C. Van Os**. 2022. Preference for competing against same vs. different parity cows at the feed bunk and relationship to feed efficiency. Annual Meeting of the ADSA. Kansas City, MO.

Dado-Senn, B., V. Ouellet, V. Lantigua, **J. Van Os**,J. Dorea, and J. Laporta. 2022. Heat stress detection and prevention in Midwestern outdoor hutch-housed dairy calves. Annual Meeting of the ADSA. Kansas City, MO.

Negreiro, A., T. Bresolin, R. Ferreira, GB. Dado-Senn, J. Laporta, **J. Van Os**, and J.R.R. Dórea. 2022. Monitoring heat stress behavior in dairy calves through computer vision systems. Annual Meeting of the ADSA. Kansas City, MO.

Drwencke, Alycia M., **Sarah J.J.Adcock, Cassandra B. Tucker**. 2022. Wound healing and sensitivity following caustic paste disbudding in dairy calves. Annual Meeting of the ADSA. Kansas City, MO.

da Silva, Tadeu, **Jennifer Van Os**, Victor Cabrera, and Kristan Reed. 2021. Predicting lameness and its impact on dairy herds: The welfare sub-module in the Ruminant Farm Systems model. Conference of Research Workers in Animal Diseases (CRWAD). Chicago, IL.

Reuscher, Kimberly J., Christina So-Hyun Yu, Rekia Salter, Tiago Bresolin, and **Jennifer M. C. Van Os.** 2021. Effects of hutch ventilation on preference and heat stress in pair-housed dairy calves. 41st ADSA Discover Conference on Food Animal Agriculture: Health Management of Calves: From Intrauterine Life to Successful Weaning. Itasca, IL.

Woods, Jocelyn,**Sarah J.J. Adcock**.2021. Validation of novel ultra-wide band technology to monitor the behavior and welfare of captive animals. Midwest Primate Interest Group. Chicago, IL.

**Van Os, Jennifer M**. and Theresa Ollivett. 2021. Comparing the content and execution of four U.S. quality-assurance schemes for calf care and management. 8th International Conference on the Assessment of Animal Welfare at the Farm and Group Level (WAFL). Virtual.

**Adcock, Sarah J.J.**, Hanna M. Butler-Struben, **Cassandra B. Tucker**. 2021. Ethanol block as a long-term analgesic for disbudding –a pilot study. 8thInternational Conference on the Assessment of Animal Welfare at Farm and Group Level(WAFL). Virtual.

Reedman, Cassandra N.,Todd F. Duffield, Trevor J. DeVries,Kerry D.Lissemore, **Cassandra B. Tucker, Sarah J.J.Adcock,** Charlotte B. Winder. 2021. Impact of plane of nutrition and NSAID treatment on wound healingfollowing cautery disbudding in preweaned dairy calves. 8thInternational Conference on the Assessment of Animal Welfare at Farm and Group Level(WAFL). Virtual.

Reuscher, Kimberly J., Christina So-Hyun Yu,GRekia Salter, Tiago Bresolin, and **Jennifer M. C. Van Os**. 2021. Preference for ventilation and social contact in pair-housed dairy calves in outdoor hutches. 54th International Congress of the ISAE. Virtual.

Reuscher, Kimberly J., Christina So-Hyun Yu, Rekia Salter, Tiago Bresolin, and **Jennifer M. C. Van Os**. 2021. Effects of hutch ventilation on preference and heat stress in pair-housed dairy calves. Annual Meeting of the ADSA. Virtual.

Reuscher, Kimberly J., Nigel B. Cook, Mario R. Mondaca, and **Jennifer M. C. Van Os**. 2021. Effects of airspeed from fans located above freestalls on heat stress and lying time. Annual Meeting of the ADSA. Virtual.

Silva, Fernanda M., **Jennifer M. C. Van Os**, Charlotte Winder, Matthew Akins, Tina Kohlman, Theresa Ollivett, Heather Schlesser, Becky Schley, Sandra Stuttgen, and Jim Versweyveld. 2021. Wisconsin farmer-reported management strategies for individually vs. socially reared pre-weaned calves. Annual Meeting of the ADSA. Virtual.

Saraceni, Julia, David Renaud, Erin Nelson, **Jennifer M.C. Van Os**, Cynthia Miltenburg, and Charlotte Winder. 2021. Opinions of Ontario producers on the use of pain control for disbudding and dehorning dairy calves. Annual Meeting of the ADSA. Virtual.

Baier, Faith S., Amanda R. Gimenez, Kaylee M. Coel, **Emily K. Miller-Cushon**, Joao R. Dorea, and **Jennifer M. C. Van Os.** 2021. Impact of stationary brush quantity on brush use in group-housed dairy heifers. Annual Meeting of the ADSA. Virtual.

Baier,Faith S., Malia J. Martin, Sophia J. Erb, Gaelan Combs, Heather M. White, Kent A. Weigel, and **Jennifer M. C. Van Os.** 2021. Evaluation of parity impact on social competition and feed efficiency in lactating dairy cows. Annual Meeting of the ADSA. Virtual.

Bresolin, Tiago, Faith Baier, **Jennifer Van Os**, and Joao R.R. Dorea. 2021. Feeding behavior of heifers monitored through computer vision systems. Annual Meeting of the ADSA. Virtual.

Reedman, Cassandra N.,Todd F. Duffield, Trevor J.DeVries, Kerry D. Lissemore, **Cassandra B. Tucker, Sarah J.J.Adcock**, Charlotte B. Winder. 2021. Impact of plane of nutrition and nonsteroidal anti-inflammatory drug treatment on wound healing following cautery disbudding in preweaned dairy calves. Annual Meeting of the ADSA. Virtual.

Saraceni, Julia, **Jennifer M.C. Van Os**, David Renaud, Charlotte Winder, Cynthia Miltenburg, Erin Nelson, Matthew Akins, Theresa Ollivett, Tina Kohlman, Heather Schlesser, Becky Schley, Sandra Stuttgen, and Jim Versweyveld. November, 2020. Disbudding and dehorning practices for pre-weaned dairy calves by farmers in Wisconsin, USA. Conference of Research Workers in Animal Diseases. Virtual.

Jones, C., Pullin, A., **Blatchford, R., Makagon, M.**, & **Horback, K**. (2021, Aug). Effect of rearing environment on the development of spatial cognition in egg-laying hens. Presented at the 28thInternational Conference on Comparative Cognition (virtual).

McVey, C., Hsieh, F., Manriquez, D., Pinedo, P., & **Horback, K.**(2021, Aug). Livestock Informatics Toolkit: Data science tools for characterizing complex behavioral patterns across multiple sensor platforms. Presented at the 54thInternational Society of Applied Ethology Congress (virtual).

Jones, C., Pullin, A., **Blatchford, R., Makagon, M., & Horback, K**.(2021, June). Effect of rearing environment on the development of spatial cognition in egg-laying hens. Presented at the 54thInternational Society of Applied Ethology Congress (virtual).

Lu, Q, Rufener, CB, **Blatchford, RA, Makagon, MM**, Toscano, MJ & Tarlton, J.(2021) The effects of rearing system design on bone mineral density and skeletal development in laying hens.Proceedings of the Annual Meeting of the Poultry Science Association.

**Pullin AN**, Rufener CB, **Millman ST**, Tarlton J, Toscano M, **Blatchford RA, Makagon MM**(2021, Nov.). The effect of pullet rearing on the distribution of adult hens in multi-tiered aviaries. Iowa Egg Industry Symposium, Ames, IA, This poster tied for 1st place in the poster competition.

**Makagon, MM**,Moore, R, **Pullin, AN & Blatchford, RA.(**2021) Do animal-mounted sensors impact hens’ movements in aviaries?Proceedings of the Annual Meeting of the Animal Behavior Society.

**Makagon, MM.**Using technology to improve laying hen welfare. UGA-Evonic Precision Poultry Farming (PPF) Training Series-delivered virtually.

**Pullin, AN**., Rufener, CB., **Millman, ST.**, Tarlton, J., Toscano, M., **Blatchford, RA & Makagon, MM.**(2022, Jan.) The role of pullet rearing and hen age on the distribution of layers in multi-tiered aviaries.Proceedings of the International Poultry Scientific Forum (Altanta, GA).

Jones, C., **Pullin, A., Blatchford, R.**, **Makagon, M**., & **Horback, K**. (2022, April). Effect of rearing environment and repeated testing on performance in depth and distance perception tasks for egg-laying hens. Presented at the 14thNorth American Regional Meeting of ISAE, Davis, CA.

Thiesen, K., Ghavamian, Y., & **Horback, K**. (2022, April). Preference for natural versus synthetic odors as olfactory enrichment for captive jaguars. Presented at the 14thNorth American Regional Meeting of ISAE, Davis, CA.

Deutsch, Z.and **Gross,J.**(2022, Feb.-March).Welfare Challenges Associated with Handling and Slaughter of Large Caviar Finfish, Aquaculture

Deutsch, Z. and **Gross, J.**(2022, April). Welfare of Farmed Fish at the Time of Slaughter, North American Regional Meeting, International Society of Applied Ethology.

**Gross, J.**(2022, June). Upstream and Downstream Animal Welfare Considerations of Fish in Aquaculture Fish Farming, American College of Animal Welfare Short Course.

**Makagon, MM.** (2022, March). The Role of Early Experience on the Behavior and Bone Integrity of Hens Housed in Cage-free Aviaries, Midwest Poultry Federation Convention, Minneapolis, MN.

**Makagon, MM.** (2022, May). Laying Hen Management and Sensing Technology, Georgia Precision Poultry Farming Conference -Virtual.

Kasakamu, M. L., Young, J. M., **Byrd, C. J.** (2022) Evaluating the use of leukocyte coping capacity as a measure of acute stress in growing pigs during a cycling heating period. Abstract accepted for oral presentation at the Annual Meeting of the American Society of Animal Sciences (June 26-30, 2022; Oklahoma City, OK).

Sommer, D. M., Young, J. M., **Byrd, C. J.** (2022) Are infrared thermography and automated feeding systems capable of identifying group-housed sow social hierarchies? Oral presentation at the 14th North American Regional Meeting of the International Society for Applied Ethology (April 29-30, 2022; Davis, CA).

McMillian, A. Magnaterra, A. Snyder, G. Martin, J. Moyle, and **S. Weimer**. Evaluating the effect of circulation fans on broiler footpad dermatitis severity in commercial houses. International Poultry Scientific Forum meeting in Atlanta, GA. January 24-25, 2022. (poster)

Khong, M., A. Snyder, A. Magnaterra, M. Young, N. Barbieri, and **S. Weimer**. Antimicrobial resistance and characterization of Escherichia coli isolated from poultry litter. International Poultry Scientific Forum meeting in Atlanta, GA. January 24-25, 2022. (oral)

Rinehart, H. A. Magnaterra, Z. McMillian, and **S. Weimer.** Comparison of the effect of enrichments on behaviors of broilers in commercial and experimental housing systems. International Poultry Scientific Forum meeting in Atlanta, GA. January 24-25, 2022. (oral)

McMillian, Z., J. Moyle, and **S. Weimer**. Decreasing contact dermatitis with circulation fans in commercial broiler houses. Poultry Science Association meeting inSan Antonio, TX. July 11-14, 2022. (poster)

Wooming, B., A. M. Stiewert, **G. S. Archer, M. Erasmus,** and **S. Weimer**. A comparison of various euthanasia devices and methods in turkey hens. American Association of Avian Pathologists meeting in Philadelphia, PA. July 29-August 2, 2022. (oral)

A.M. Arias-Esquivel, S. DeNotta, L.A. Rodríguez, J.M. Bobel, K. Brinkley-Bissinger, A.C.C.M. Vasco, C.N. Rodríguez, M.C. Lee, L.K. Warren, **C.L. Wickens**. 2021. Evaluation of gastric health in cribbing horses fed a digestive support supplement. J. Equine Vet. Sci. 100 (Abstract 54): 103517. https://doi.org/10.1016/j.jevs.2021.103517.C.

Heleski, P. McGreevy, M. Peterson, K. Thompson, **C. Wickens**, J. Williams. 2021. The power of word choice –case in point, the whip/crop debate. Proceedings of the 17th International Society for Equitation Science Conference, October 20-22 (Online Conference), Pp. 73-74 (Keynote Abstract 3).

B. Justesen, J. Yarborough, J. Strickland, **C. Wicken**s, S. DeNotta, J. McQuagge. 2021. Building partnerships with mounted patrol units in North America. Accepted for presentation at the 2021 UF/IFAS EPAF Conference (Virtual Meeting Poster Session), September 14-16.

B. Powell, K. Horvath, **C. Wickens, E. Miller-Cushon**, A. Keil, S. Brooks. 2021. Refined phenotyping methods for the equine cardiac startle response. J. Equine Vet Sci. 100 (Abstract 35): 103498. <https://doi.org/10.1016/j.jevs.2021.103498>.

December 14th, 2021.Characterizing the Dog-Human Bond: A Comparative Investigation of Attachment Relationships.Hour long presentation for anInternationalCanine Seminar, hosted by Dr. Clive Wynne at Arizona State University, broadcasted live internationally

November 29th, 2021 (recording date). Importance of child-animal bonds and parallels in attachment behavior across species.Invited hour long podcast speaker/interviewee for Supporting Child CaregiversPodcast (<https://supportingchildcaregivers.org/>).

**Udell, M.A.R.(**November 4th, 2021). Human-Animal Interaction Lab Overview. Centers for the Human-Animal Bond Conference, Purdue University.

**Udell, M. A. R.** (August 12th, 2021). Are Dogs Social Generalists? Implications for the Dog-Human Bond. Invited talk as part of Symposium 35: What is the Secret of Dogs’ Success in the Human-Dominated World? American Psychological Association conference San Diego California, USA.

**Udell, M. A. R.** (August 7th, 2021). Cats can be social too! Understanding and Supporting the Human-Cat Bond. Animal Behavior Society Conference (virtual due to COVID-19)

Perttu, R.K and **M.I. Endres.** 2022. Associations between feeding behaviors and management practices in automatically fed grou-housed dairy calves in the Upper Midwest USA. 2022. Pg 166 in Proc. 55thCongress of the ISAE. Sept 2022.

Perttu, R.K, M. Peiter, T. Brezolin, J.R.R Dorea, and **Mi.I. Endres**. 2022. Feeding behaviors collected from automated milk feeders were associated with diseasein group-housed dairy calves in the upper MidwestUSA. Pg 52 in Proc. 3rdInternational Conference on Precision Dairy Farming, Vienna, Aug 30 to Sept 2, 2022

Gonçalves da Costa, B., K. Sharpe, **M. Endres**, and B.Heins.2022. Health assessment of calves raised in alternative rearingsystems.J. Dairy Sci. Vol. 105, Suppl. 1:15.

Gonçalves da Costa, B, K. Sharpe, **M. Endres,** and B. Heins. 2022. Lying behavior of dairy calves in alternative rearing systems.J. Dairy Sci. Vol. 105, Suppl. 1:74.

Bacon, M, **M. Endres,** and B. Heins. 2022. Effects of multimodal pain relief on stress in disbudded dairy calves under organic management. J. Dairy Sci. Vol. 105, Suppl. 1:128.

Bacon, M, **M. Endres**, and B. Heins. 2022. Effects of willow bark (Salix) on pain and stress inrecently disbudded organic dairy calves.. J. Dairy Sci. Vol. 105, Suppl. 1:128.

K. Sharpe, B. Heins, **M. Endres**, and H. Phillips. 2021. Salix extract and flunixin meglumine dosage to minimize inflammation after disbudding in dairy calves. J. Dairy Sci. Vol. 104, Suppl.1:36.

Preweaned calf rearing options for dairy producers. B.J. Heins, **M.I. Endres,** and K.T. Sharpe. 2021. J. Dairy Sci. Vol. 104, Suppl.1:351.

**Endres, M.I.** 2021. Future of dairy cattle housing from a U.S. perspective. 72ndEAAP Annual Mtg.:406.Joint EAAP/ADSA session.

Perttu, R., B. Ventura, A. Rendahl, **M. Endres**. 2021. Public views of dairy cattle welfare and dairy consumption habits of youth and adults. 8th WAFL International Conference (Assessment of Animal Welfare at Farm and Group Level), Cork, Ireland

Ross,C.E.,G.A. Mills, **A.T. Desaulniers,** C.A. Lents, and B.R. White.2022.Quality assessments of sperm from GnRH-II receptor knockdown (KD) boars. ASAS-CSAS-SSASASJointAnnual Meeting. Awarded 1stPlace in PhD poster competition.

Nordell\*,N.E.,L.K. Clifton\*,A.M. Petty\*, M.L. Burns\*,and **A.T. Desaulniers**. 2022.Early-weaned males have smaller testes, impaired development of seminiferous tubules, and subfertility. Society for the Study of Reproduction Annual Meeting.

Ross,C.E.,G.A. Mills, **A.T. Desaulniers,** C.A. Lents, and B.R. White.2022.GnRH-II and its receptor influence sperm morphology and kinematics.Society for the Study of Reproduction Annual Meeting.

Clifton\*,L.K.,A.M. Petty\*, M.L. Burns\* and **A.T. Desaulniers**.2022.Early weaning impairs reproductive development and fertility of the male. ASAS Midwestern Section Annual Meeting.

Ross,C.E.,**A.T. Desaulniers**, R.A. Cederberg, G.A. Mills,C.A. Lents,and B.R. White. 2022. Serum chemistry metabolomic profiles of GnRH-II receptor knockdown and littermate control boars.NPOD Spring Retreat.

Faltas\*,S.S.,C. Nguyen\*, M.L. Burns\*, A.M. Petty\*, L.E. Clifton\*, K.W. Lovercamp, **A.T. Desaulniers**.2022.The effect of corncob bedding on murine testis composition. UNL Undergraduate Research Fair.

Nguyen,C., S.S. Faltas,M.L. Burns, A.M. Petty, L.E. Clifton, K.W. Lovercamp, **A.T. Desaulniers**.2022.Leydig cell metrics in male mice exposed to environmental phytoestrogens during reproductive development.UNL Undergraduate Research Fair.

Sundman E. R., N. K. Gabler, **S. T. Millman**, K. J. Stalder, L. A. Karriker, and **A. K. Johnson.** 2022. Neonatal piglet interaction with environmental enrichment topes and impacts on mortality and litter weight gain. Presented at theNorth American International Society of Applied Ethology.

Sundman, E. R., D. L. Fortney, N. K. Gabler, **A. K. Johnson, S. T. Millma**n, and C. R. Stambuk. 2022. Validation of scan sampling techniques for nursery pig feeder and enrichment use.Presented at International Society of Applied Ethology55thconference in North Macedonia.

Geary, A., E. Sundman, N. Gabler, K. Stalder, L. Karriker., **S. Millman and A. Johnson.** 2022. Use of biologically relevant enrichment to improve nursery-aged pig weaning transition. Accepted as an Animal Industry Report, September 2022.

Mercer, G., E. Sundman, N. Gabler, **A. Johnson,** L. Karriker, **S. Millman,** K. Stalder, and C. Stambuk. 2022. Effects of nutritional enrichment on pig feeder aggression and performance during early weaning. Animal Industry Report R13898. <https://www.iastatedigitalpress.com/air/article/id/13898/>

Stambuk, C., E. Sundman, G. Mercer\*, N. Gabler, L. Karriker, **S. Millman**, K. Stalder, and **A. Johnson.** 2021. Nutritional enrichment effect on behavior, performance during early weaning. National Hog Farmer. October 21st2021. Available at: <https://www.nationalhogfarmer.com/news/nutritional-enrichment-effect-behavior-performance-during-early-weaning?NL=NHF-001&Issue=NHF-001_20211021_NHF-001_635&sfvc4enews=42&cl=article_1_b&utm_rid=CPG02000008374745&utm_campaign=62593&utm_medium=email&elq2=7b4bd1b3e0da462a946123edc26b48a4>

Sundman, E., N. K. Gabler, **S. T. Millman**, K. J. Stalder, L. A. Karriker and **A. K. Johnson**.2021. The use of attractants to stimulate neonatal piglet interest in rope enrichment. International conference in pig survivability. Omaha, Nebraska, USA. Total of 451 persons attended this two-day event, with 29 U.S. states represented, 5 Countries and 175 companies.

Sundman, E., N. K. Gabler, **S. T. Millman**, K. J. Stalder, L. A. Karriker and **A. K. Johnson**.2021. Nutritional enrichment to improve the weaning transition of nursery aged swine. International conference in pig survivability. Omaha, Nebraska,USA. Total of 451 persons attended this two-day event, with 29 U.S. states represented, 5 Countries and 175 companies.

Sundman, E. S., N. G. Gabler, **S. T. Millman**, K. J. Stalder, L. A. Karriker, and **A. K. Johnson**. 2021. Nutritional enrichment to improve the welfare of nursery-aged swine at weaning. Presented at Advancing Animal Welfare together symposium. Sponsored by Merck Animal Health. Monday November 15thto Wednesday 17thNovember 2021, Orlando, FL. Abstract was selected by Dr. A. Baysinger Animal Welfare lead, North America for presentation.

Geary A., C. Stambuk, E. Sundman and **A. Johnson.** 2021. Use of biologically relevant enrichment to improve the weaning transition of nursery-aged swine. Senior Honors Project, presented at Iowa State University Honors Poster Presentation, Ames, IA.

Mercer, G., C. Stambuk, E. Sundman and **A. Johnson**. 2021. Effects of novel nutritional enrichment on pig feeder aggression during early weaning. Senior Honors Project, presented at Iowa State University Honors Poster Presentation, Ames, IA.

Harrison C (graduate student), Jones J, Bridges W, **Ali A.**  Novel quantitative radiographic measures of keel bone damage in laying hens are feasible and repeatable. 2021 ACVR Scientific Conference, Virtual, USA, Oct. 20-23, 2021. Abstract published in: Rademacher, N. Abstracts from the 2021 ACVR Scientific Conference, Virtual, USA, October 20-23, 2021. Vet Radiol Ultrasound. 2022; 63: 364–382. <https://doi.org/10.1111/vru.130522>

Cohen S (undergraduate research student), Kozuch L (undergraduate research student), Harrison C (graduate student), Jones J, Bridges W, **Ali A.** Are CT measures of poultry keel bone volume and density feasible and reproducible using HOROS open-source image analysis software? 17th Annual Focus on Creative Inquiry Poster Forum April 6, 2022. Clemson, SC. <https://ci.clemson.edu/assets/docs/foci/2022.pdf>

B.L. Silvers**, J.L. Leatherwood,** A.N. Bradbery, C.P. Guy, R.E. Martinez, M.L. Much, J. Keshri, S.C. Dass, S. H. White-Springer. 2021. J. Equine Vet. Sci. 100:103486.

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