**Basic Information**

* **Project No. and Title:** [W3173 : Impacts of Stress Factors on Performance, Health, and Well-Being of Farm Animals (from W2173)](https://www.nimss.org/projects/17096)
* **Period Covered:** 10/01/2019 to 09/30/2020
* **Annual Meeting Dates:** 12/07/2020 to 12/09/2020

## Meeting Minutes

## Monday, Dec 7th

Attendance: Duarte Diaz and Benjamin Renquist (University of AZ), Eileen Fabian (Penn State University), Sabine Mann (Cornell), Robert Godfrey (University of the Virgin Islands), Yuzhi Li (University of Minnesota), Yihang Li (University of Delaware), Jessica Petersen, Ty Schmidt and Dustin Yates (University of Nebraska), Juliana Ranches (Oregon State University), Carrie Vance (Mississippi State University), Anthony Parker (Ohio State University)

### Activities/Discussion:

*Welcome and brief introductions*

*Discussion of electing a secretary (next meeting chair/host)*. Our project outline names three “officers,” the ex-chair, chair, and secretary. Each year a secretary is to be elected. That person takes notes/minutes and then acts as the chair in the subsequent year, assisted by the ex-chair (chair from the prior year). Responsibilities of the chair are to organize and host the annual meeting, and lead compilation of station reports for project reporting. It was noted that the location of the meeting does not have to coincide with the institution at which the chair is located. After discussion, election of next chair (secretary for this year) was tabled until Tuesday. The UNL group would take minutes for this meeting.

*Station Reports* (collaborative opportunities/needs summarized below)

## Tuesday, Dec 8th

Attendance: Duarte Diaz and Benjamin Renquist (University of Arizona), Eileen Fabian (Penn State University), Kifle Gebremedhin and Sabine Mann (Cornell University), Robert Godfrey (University of the Virgin Islands), Yuzhi Li (University of Minnesota), Jessica Petersen, Ty Schmidt, Ruth Woiwode and Dustin Yates (University of Nebraska), Juliana Ranches (Oregon State University), Cassandra Tucker (University of California - Davis), Anthony Parker (Ohio State University), Shawna Weimer (University of Maryland), Timothy Sullivan (NIFA)

### Activities/Discussion:

*Brief introductions*

*Dr. Tim Sullivan* is our new NIFA representative and National Program Leader for Animal Health. Tim presented information on changes at NIFA largely centered around the relocation of the office to Kansas City. Staff is now at approximately 60% after rehiring efforts. Changes in leadership are outlined in the provided document (attached) – as is contact information for National Program Leaders and others in the Division of Animal Systems. RFAs for 2021 AFRI programs are out with most deadlines on May 6th. Award sizes have been increased to $650K for up to 5 years. Seed grants are now also available for new investigators with an increased maximum budget of $300K. The handout highlights the programs available and other interagency funding opportunities. Anyone interested in the USDA/NIH Dual Purpose with Dual Benefit program (recently sunset) should contact Mark Mirando to express interest in reviving this effort.

*Station Reports* (collaborative opportunities/needs summarized below)

*Hosting the 2021 meeting*. Tony Parker (Ohio State) agreed to host. Yuzhi Li (Minnesota) offered to be a back-up host if needed. A doodle or similar poll will be sent out next spring to determine meeting dates. The group is hopeful it can be held in person but will keep a virtual attendance option.

*Participation in W3173*. Significant discussion focused on how to incentivize participation in annual meetings and collaborations. The program currently has 58 members listed; some are known to have retired and others participate on varied levels (e.g., attend meetings, contribute station reports, do not participate). Ways to promote and document participation were discussed. Another Multistate has a policy of removing members who have not been active for 3 consecutive years; this was considered. It was later agreed upon that stations not submitting an annual report, and attendance at the annual meeting would be documented each year. Current W3173 co-chairs would discuss with our administrative advisor (Bill Payne) ideas regarding how to document and increase participation. Dr. Sullivan also visited with others at NIFA about this topic, which seems to be a point of discussion in several other Multistate groups.

The possibility of including an internet link on the project webpage that lists the specific research interests and collaborative opportunities was discussed. This would help colleagues find collaboration opportunities to enhance activities among group members. How this can be accomplished will be discussed with our administrative advisor.

*Impact writing workshop*. Most all attendees remained online to participate in the impact writing workshop led by Sara Delheimer (Multistate Research Funds Impact Program). Emphasis was on conveying four components of the statement: Issue, Action, Output, and Impact. These statements, included in each year’s report, are used by program leaders and PR personnel to promote activities of the group to the public. Handouts provided for the workshop are attached.

Sara also shared the following websites with examples of impact statements:

* [https://www.mrfimpacts.org/impact-statements](https://urldefense.proofpoint.com/v2/url?u=https-3A__www.mrfimpacts.org_impact-2Dstatements&d=DwMFAg&c=Cu5g146wZdoqVuKpTNsYHeFX_rg6kWhlkLF8Eft-wwo&r=lpPpwZhuTNZFXGUDOPFgPnUckOPBqSXGIjs6PJzrDDw&m=vuaC3Zq3AhNDYiRaiwM3Fwj9oWaupNZUkiVaOEyvePI&s=j43HNtvRjP6Dac4SFb1HyXI7PAFCrhjdA4kUK5DwGOo&e=)
* [https://landgrantimpacts.org/areas-of-impact/](https://urldefense.proofpoint.com/v2/url?u=https-3A__landgrantimpacts.org_areas-2Dof-2Dimpact_&d=DwMFAg&c=Cu5g146wZdoqVuKpTNsYHeFX_rg6kWhlkLF8Eft-wwo&r=lpPpwZhuTNZFXGUDOPFgPnUckOPBqSXGIjs6PJzrDDw&m=vuaC3Zq3AhNDYiRaiwM3Fwj9oWaupNZUkiVaOEyvePI&s=ivdOkaoX9czGwwTq_VurGa4eOF70SXBpI67HZtCTue4&e=) (click on the different topics to read impact stories and fact sheets for each)
* [https://nifa.usda.gov/impacts](https://urldefense.proofpoint.com/v2/url?u=https-3A__nifa.usda.gov_impacts&d=DwMFAg&c=Cu5g146wZdoqVuKpTNsYHeFX_rg6kWhlkLF8Eft-wwo&r=lpPpwZhuTNZFXGUDOPFgPnUckOPBqSXGIjs6PJzrDDw&m=vuaC3Zq3AhNDYiRaiwM3Fwj9oWaupNZUkiVaOEyvePI&s=EYlvRFnQBai18paAqSp-tsPXrE6nTv2fhGuqObZ2s0s&e=)
* It may also help to read news stories produced by your college to see how they write about your work or similar work. For example: [https://news.psu.edu/story/629554/2020/08/25/research/aspirin-after-calving-can-provide-relief-dairy-cows-increase-milk](https://urldefense.proofpoint.com/v2/url?u=https-3A__news.psu.edu_story_629554_2020_08_25_research_aspirin-2Dafter-2Dcalving-2Dcan-2Dprovide-2Drelief-2Ddairy-2Dcows-2Dincrease-2Dmilk&d=DwMFAg&c=Cu5g146wZdoqVuKpTNsYHeFX_rg6kWhlkLF8Eft-wwo&r=lpPpwZhuTNZFXGUDOPFgPnUckOPBqSXGIjs6PJzrDDw&m=vuaC3Zq3AhNDYiRaiwM3Fwj9oWaupNZUkiVaOEyvePI&s=kKuVAf_MDSR3Af0O8RwaS9Vw5v8gZVz7kUlyJbYxnRg&e=).

## Wednesday, Dec 9th

Attendance: Duarte Diaz and Benjamin Renquist (University of Arizona), Robert Godfrey (University of the Virgin Islands), Yuzhi Li (University of Minnesota), Jessica Petersen, Ty Schmidt and Dustin Yates (University of Nebraska), Juliana Ranches (Oregon State University), Anthony Parker (Ohio State University), Shawna Weimer (University of Maryland)

### Activities/Discussion:

*Proposal for program renewal.* The proposal to renew the Multistate is due Jan 15th, 2021. The UNL group will lead this effort and will ask for input/assistance along the way.

It was agreed that the name of the project would be changed slightly to: Impact of Stress on Performance, Health, and Well-Being of Animals. The previous title specified “farm animals,” which membership thought could be restrictive of the study and use of model organisms, companion animals, and wildlife.

Proposed Objectives were sent out by email prior to the meeting. It was agreed that keeping the objectives broad allows for a more inclusive environment and provides flexibility as needs in the industry may change. Based upon the suggestion of the prior project review and the large expertise in extension of the group, an objective focused on dissemination of material was added. After discussion, the following four objectives to be proposed in the renewal document were agreed upon:

1. Identify and characterize the biology of stress responses that affect animal well-being and production
2. Identify genetic and epigenetic components of animal stress and how they impact performance and well-being
3. Develop tools, advanced precision livestock technologies, and management strategies that reduce stress and enhance animal well-being
4. Disseminate research findings, new technologies, and management recommendations to scientific, industry, and consumer audiences

*Reminder: Station reports are due Dec 31st using an Excel template sent out via email.*

*The meeting was adjourned.*

## Summary of collaborative opportunities/needs of participants from Station Reports given during the meeting

* Bob Godfrey
To offer – body temp measurements, heat stress studies in cattle and sheep

Seeking – collaborators to replicate studies with similar breeds and management but different environments

* Tony Parker

To offer – cattle and sheep management, animal and farm facilities, stress and metabolism physiology laboratory

Seeking – similar expertise, climate change focus, studies of the body’s response to stress

* Sabine Mann

To offer – access to animals and research facilities at Cornell, immunologic and molecular techniques, core facilities

Seeking – work in area of neonatal innate immunology, complement factors in immune function, nutrient use by immune system, interplay of metabolism, nutrition, inflammation

* Ben Renquist/Duarte Diaz

To offer – mouse model experience, heat chambers (rodent, sheep, cattle), nutrition expertise

Seeking – dairy research collaborators with university facilities

* Jessica Petersen/Ty Schmidt/Dustin Yates

To offer – genomics/transcriptomics experience, physiological methodology, animal handling and environmental chambers (sheep), tracking system/software and guidance

Seeking – additional questions that can be asked using samples data on hand or planned, mtDNA expertise, additional animal models for stress

* Yuzhi Li

To offer – optical flow algorithm, kinematics to define facial expression, equipment and technology sharing

Seeking – ability to monitor individual pig location and activity, statistician for social network analysis

* Yihang Li

To offer – chamber system, intestinal organoid studies, poultry facility

Seeking – tissue metabolism analysis under stress, body composition methodology, interest in adult stem cells and enteric nerve system

* Juliana Ranches

To offer – mineral nutrition of beef cattle, beef cattle management, animals, facilities, physiology lab

Seeking – insight and lab assays regarding vitamin nutrition of beef cattle

* Eileen Fabian

To offer – farm animal research centers (layer, broiler, turkey, swine, equine, dairy, beef, sheep), on-farm projects, instrumentation development/analysis

Seeking – partnerships for behavior, welfare, and physiology responses, funding partnerships for graduate students

* Cassandra Tucker

To offer – measurement of heat load, animal behavior and welfare expertise

Seeking – studies/expertise on drinking water quality and its interactions with heat load

* Shawna Weimer

To offer – ethology, stress physiology, broiler industry expertise, experimental and commercial research facilities, fun tools(!), students to code behavior.

Seeking – expertise in neuroscience, economy, engineering (sensors), statistics (categorical) and tech development resources

# W3173 2020 – Research Overview

Station (University/Organization):

* Colorado State University/Department of Animal Science

Researcher/ Research Team *(Name and e-mail)*:

* Lily Edwards-Callaway (lily.edwards-callaway@colostate.edu)
* John Wagner (john.wagner@colostate.edu)
* Terry Engle (terry.engle@colostate.edu)

Primary Research Interests and Objectives related to W3173:

* Identify measures of animal stress and well-being and characterize factors affecting the biology of stress and immune responses.

Collectively, our research efforts are directed toward this objective and will help to identify management practices that will improve animal productivity and welfare by reducing animal stress. In addition, our efforts will advance the understanding of the biology of the stress response, mineral metabolism, and immunity in beef cattle.

Impact Statement for Primary W3173 Research (will be template for impact writing workshop):

Stress is the nonspecific response of the body to any demand made upon it (Selye, 1973). The negative impact of stress on disease resistance and animal wellbeing in food producing animals has long been recognized. Stressors relative to animal production include a variety of circumstances such as infection, environmental factors, parturition, lactation, weaning, transport, handling, painful procedures, and nutritional imbalances. Through significant efforts of this group, the biochemical mechanisms indicative of the stress response related to some of these specific management and environmental factors are becoming better understood. Collaborative research initiated by the W-3173 group has produced recommendations of how to measure, model, and mitigate stress (environmental, immunological, nutritional, genetic, transportation, behavioral, etc.) in food producing animals to optimize animal performance and enhance animal welfare.

Researcher / Research Team Related Publications (last 3 years):

**Books:**

1. The Welfare of Cattle. 2019. Eds. T. E. Engle, D. J. Klingborg, and B. E. Rollin. CRC Press Boca Raton, FL. USA. (ISBN 978-1-138-19706-0).

**Chapters in Books:**

1. Edwards-Callaway, L.N. and T. Widowski, Animal Behavior and Emotions – On-Farm Considerations, In: Improving Animal Welfare: a Practical Approach. Ed. T. Grandin. CABI Publishing. Wallingford, UK, In Press.
2. Edwards-Callaway, L.N. and H. C. Kline, 2020, The Basics of Bruising in Cattle – What, When, and How. In: The Slaughter of Farmed Animals: Practical Ways of Enhancing Animal Welfare. Ed: T. Grandin and M. Cockram. CABI Publishing.
3. Johnson, A. K., J. D. Colpoys, L. N. Edwards-Callaway, M. Calvo-Lorenzo, J. J. McGlone, S. T. Millman, C. E. Philips, M. J. Ritter, M. A. Sutherland, A. Tucker and S. R. Webb, 2019, Chapter 3: Behavior and Welfare. In. Swine Diseases, John Wiley & Sons, Inc, 32-50.
4. Edwards-Callaway, L. N., 2018, Sense and Sensibility: How Cattle Perceive our Collective World, In: The Welfare of Cattle: Eds. Engle, T., D.J. Klingborg, and B. E. Rollin. CRC Press. 73.
5. Ahola, J. K., J. J. Wagner, and T. E. Engle. 2019. An overview of the segments of the beef cattle industry and animal welfare implications of been industry practices. In: The Welfare of Cattle. Eds. T. E. Engle, D. J. Klingborg, and B. E. Rollin. CRC Press Boca Raton, FL. USA. Pp.173-179. (ISBN 978-1-138-19706-0).

**Refereed Journal Articles:**

1. Edwards-Callaway, L.N., M.C. Cramer, C. Cadaret, E. Bigler, T. Engle, J.J. Wagner, and D. Clark, Board Invited Review: Impacts of shade on cattle well-being in the beef supply chain, Journal of Animal Science, *In Press*.
2. Johnstone, E.C.S., J. Coetzee, P. Pinedo, and L.N. Edwards-Callaway. Survey investigating current attitudes towards use of pain mitigation practices in beef and dairy cattle in the US by veterinarians and producers. Journal of the American Veterinary Medical Association, Refereed, *In Press*.
3. Thorndyke, M. P., O Guimaraes, N. M. Tillquist, J. Zervoudakis, and T. E. Engle. 2020. Molybdenum exposure in drinking water or feed impacts apparent absorption of copper differently in beef cattle consuming a high forage diet. *Biol. Trace Element Res.* (*In press*)
4. Jalali, S., K. D. Lippolis, J. K. Ahola, J. J. Wagner, J. W. Spears, D. Couch, and T. E. Engle. 2020. Influence of supplemental copper, manganese, and zinc source on reproduction, mineral status, and performance in a grazing beef cow-calf herd over a 2-year period. Appl. Anim. Sci. *(In press)*
5. Baier, F.S., T. Grandin, T.E. Engle, S.L. Archibeque, J.J. Wagner, and L.N. Edwards-Callaway, 2020, Impact of liver abscess presence on stress related physiological parameters associated with well-being in feedlot cattle. Applied Animal Science, 36, 437-46.
6. Casagrande, R.R., L. Alexander, L.N. Edwards-Callaway, Effects of gun model and number of stuns on stunning-related variables of cattle in a 1 commercial slaughter facility, Meat Science, Meat Science, 170, 108231..
7. Edwards-Callaway, L.N. and M. S. Calvo-Lorenzo, 2020, Board Invited Review: Animal welfare in the U.S. slaughter industry- A focus on fed cattle, Journal of Animal Science, 98, 1-21.
8. Kline, H.C., Z. D. Weller, T. Grandin, R. Algino, K. E. Belk, and L.N. Edwards-Callaway, 2020, Accuracy of visual evaluation of carcass bruise trim weight, Meat and Muscle Biology, 4, 1-6.
9. Kline, H.C., Z. Weller, T. Grandin, R. Algino, and L.N. Edwards-Callaway, 2020, From unloading to trimming: studying bruising in individual slaughter cattle, Translational Animal Science, 4: 1-9.
10. Mijares, S., M. Davis, J. Ahola, L. Bigler, T. Engle, L. Alexander, and L.N. Edwards-Callaway, Development and validation of a mud scoring system for use in cattle at slaughter – A short communication, Meat Science, 172, 108354.
11. Ohlheiser, A.L., J.K. Ahola, F. S. Baier, R.J. Callan, A. S. Lear, S.R. Byers, and L.N. Edwards-Callaway, 2020, Oxytetracycline injection site reactions provide a model to assess nociception by pressure algometry and mitigation by flunixin meglumine in dairy cows, American Journal of Veterinary Research, 81, 471-8.
12. Walker, J., I.N. Roman-Muniz, and L.N. Edwards-Callaway, 2020, Timely Euthanasia in the United States Dairy Industry – Challenges and a Path Forward, Animals, 10, 71.
13. Zanetti, D., L. A. Godoi, B, M. M. Estrada, T. E. Engle, M.V.C. Pacheco, J.M.V. Pereira, E. Detmann, M.F. Paulino, S.C. Valadares Filho. 2020. Influence of a mineral supplement containing calcium, phosphorus and micronutrients on intake, digestibility, performance and mineral status in young Nellore bulls in a Feedlot. *Anim. Prod. Sci.* 60: 277-287.
14. Baier, F., T. Grandin, T.E. Engle, and L.N. Edwards-Callaway, 2019, Evaluation of hair characteristics and animal age on the impact of hair cortisol concentration in feedlot steers. Frontiers in Veterinary Science, 6: 1-7.
15. Edwards-Callaway, L.N., J. Walker, C, Tucker, 2019, Perspective: Culling decisions and dairy cattle welfare during transport to slaughter in the United States. Frontiers in Veterinary Science, 5:343.
16. Johnstone, E., M. Frye, L. Lord, A. Baysinger, L.N. Edwards-Callaway, 2019, Attitudes and competencies of third year veterinary students relevant to animal welfare before and after implementation of a core welfare course, Frontiers in Veterinary Science, 6: 103.
17. Kline, H., L.N. Edwards-Callaway, and T. Grandin, 2019, Field Observation: Pen stocking capacities for overnight lairage of finished steers and heifers at a commercial slaughter facility. Applied Animal Science, 35: 130-133.
18. Kline, H., D. Wagner, L.N. Edwards-Callaway, and T. Grandin, 2019, Pilot Study: effect of captive bolt gun length on brain trauma and post-stun hind limb activity in fed cattle. Meat Science, 155: 69-73.
19. Martin, M., S.A. Grau, L. N. Edwards-Callaway, B.W. Rutherford, T. Grandin, 2019, Survey of Cow Calf Producer Perspectives on Management Strategies and Industry Challenges Part 2: Marketing and Selection Decisions, Translational Animal Science, 3: 225–236.
20. Wagner, D.R., H.C. Kline, M.S. Martin, L.R. Alexander, T. Grandin, L.N. Edwards-Callaway, 2019, The effects of bolt length on penetration hole characteristics, brain damage and specified-risk material (SRM) dispersal in fed cattle stunned with a penetrating captive bolt stunner. Meat Science, 155: 109-114.
21. Budde, A.M., K. Sellins, K.E. Lloyd, J.J. Wagner, J.S. Heldt, J.W. Spears, and T.E. Engle. 2019. Effect of zinc source and concentration and chromium supplementation on performance and carcass characteristics in feedlot steers. *J. Anim. Sci.* 97:1286-1295.
22. Castro, M. M. D., A. L. Silva, L. F. Costa e Silva, P. P. Rotta, T. E. Engle and M. I. Marcondes. 2019. Determination of macromineral requirements for preweaned dairy calves in tropical conditions. *J. Dairy. Sci.* 102: 2973-2984.
23. Martin, M., S.A. Grau, B.W. Rutherford, T. Grandin, L. N. Edwards-Callaway, 2018, Survey of Cow Calf Producer Perspectives on Management Strategies and Industry Challenges Part 1: Handling Practices and Health and Industry Challenges. Translational Animal Science, 3(1): 1-9.
24. Martin, M.S., H. Kline, D. Wagner, L. Alexander, L. N. Edwards-Callaway, T. Grandin. 2018. Evaluation of different captive bolt lengths and breed influence upon post-stun hind limb and forelimb activity in fed cattle at a commercial slaughter facility, Meat Science, 143: 159-164.
25. Vogel, K.D., Lee, T.L., Feinberg, B., Loneragan, G.H., Walker, J., Edwards-Callaway, L.N., Siemens, M.G., and Thomson, D.U., 2018. An intercontinental survey of commercial abattoirs: Preliminary data on the prevalence of advanced pre-slaughter health and welfare conditions in mature cows. The Bovine Practitioner, 52 (2): 109-118.
26. Desalegn, T. A Tolera, A. Nufeta, and T. Engle. 2018. Indigenous mineral supplements of livestock and farmers’ perception on the supplements in Wolaita Lowlands, Southern Ethiopia. *Eth. J. Anim. Prod.* 18:74-87.

Future Research Direction Related to W3173:

Slaughter animal welfare research:

Our research team has a strong collaborative relationship with the packing sector of the beef supply chain. Our industry partnerships have enabled us to conduct critical research in the space of slaughter animal welfare, emphasizing our recognition and trust within the processing sector of the industry. Additionally, our team looks to identify practical approaches to linking improvements in animal welfare at slaughter to profitability of the entire system. Future research will include continued: 1) exploration of improvements in stunning practices at packing plants; 2) development of industry animal welfare benchmarking efforts for important well-being measures such as mobility and bruising; and 3) investigation into repeatable measures of pain related to management procedures in livestock and subsequent perceptions of pain mitigation techniques that have assisted the industry in improving animal welfare.

Trace minerals:

Trace minerals are involved in growth, reproduction, immunity, and carbohydrate and lipid metabolism in beef cattle. A key component to mineral absorption by an animal is solubilization of a given element within the digestive tract. Factors that influence solubilization can alter the availability of trace minerals. During rumen fermentation several mineral antagonists can be produced that can reduce solubilization and absorption of trace minerals ultimately impacting overall animal health. Deficiencies and or imbalances in trace minerals can impair specific metabolic pathways and ultimately immune function. However, little is understood in ruminants regarding trace mineral absorption, metabolism, and how trace minerals interact with the immune system. Therefore, we will continue research examining: 1) trace mineral transporters in ruminal epithelium and duodenal enterocytes; and 2) the influence of Cr, Cu, Mn, and Zn supplementation on feedlot cattle immunity, performance, and carcass characteristics and nutrient composition.

# W3173 2020 – Research Overview

Station (University/Organization):

* Cornell University

Researcher/ Research Team *(Name and e-mail)*:

* Sabine Mann sm682@cornell.edu (new to multistate project in 2020)

Primary Research Interests and Objectives related to W3173:

For W3173 objective 1 (Identify measures of animal stress and well-being and characterize factors affecting the biology of stress and immune responses):

1) Characterize the effect of non-Ig colostrum components on immune response of calves

For W3173 objective 3 (Development of management strategies and/or tools to enhance farm animal well-being under conditions of climatic change or other stressful environments):

1. Characterize the change of components from colostrum to transition milk to understand impact of colostrum management strategies on well-being of calves
2. Characterize the effect of storage and heat treatment on non Ig-G components

These are carried out in collaboration with Dr. Johan Osorio.

Impact Statement for Primary W3173 Research (will be template for impact writing workshop):

To date, our colostrum management recommendations fail to account for important non-immunoglobulin components in the first and subsequent milkings of dairy cows, as well as the potential detrimental effects of industry-wide practices such as freezing and heat-treatment.

Now is the time to address this critical gap in knowledge, and open the opportunity to better use these immunologically active components for the benefit of the dairy industry. Increasing calf health is of importance to the public: it increases animal wellbeing, decreases use of antimicrobials, and adds to the sustainability of the dairy industry.

Researcher / Research Team Related Publications (last 3 years):

NO PUBLICATIIONS YET RELATED TO W3173 SINCE RESEARCH TEAM JOINED IN 2020

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| OTHER RELATED PUBLICATIONS TO THE INTERESTS OF THE RESEARCHER:Mann S., Curone G., Chandler T.L., Moroni P., Cha J., Bhawal R., Zhang S. Heat treatment of bovine colostrum. I. Effects on bacterial and somatic cell counts, immunoglobulins, growth factors, and the proteome of colostrum. *Journal of Dairy Science* – (2020) 103 (10): 9368-9383 |
| Mann S., Curone G., Chandler T.L., Sipka A.S., Cha. J., Bhawal R., Zhang S. Heat treatment of bovine colostrum. II. Effects on calf serum immunoglobulin and growth factor concentrations and the serum proteome. *Journal of Dairy Science* *–* (2020) 103 (10): 9384-9406 |
| McArt J.A.A., Abuelo A., Mann S. Metabolic disease testing on farms: Epidemiological principles. *In Practice* (2020) 42:405-414 |
| Leal Yepes F.A., Mann S., Martens E. M., Velasco Bolanos J., Ceballos Marquez A., Puerto S., Gómez M.I., McArt J.A.A. Blood ß-hydroxybutyrate concentrations and early lactation management strategies on pasture-based dairy farms in Colombia. *Preventive Veterinary Medicine* (2020) 174:104855 |
| §Sipka A., Chandler T.L., Behling-Kelly E.L., Overton T.R., Mann S. The effect of ex vivo lipopolysaccharide stimulation and nutrient availability on transition cow innate immune cell AKT/mTOR pathway responsiveness. *Journal of Dairy Science* – (2020) 103 (2): 1956-1968 |
| Leal Yepes F.A., Mann S., Overton T.R., Ryan C.M., Bristol L.S., Granados G.E, Nydam D.V, Wakshlag J.J. Effect of rumen protected branched-chain amino acids supplementation on production and energy related metabolites during the first 35 DIM in Holstein dairy cows. *Journal of Dairy Science* (2019) 102 (6): 5657-5672. |
| Mann S., McArt J.A., Abuelo A. Production-related metabolic disorders of dairy cattle: ketosis, milk fever, and grass staggers. *In Practice* (2019) 41 (5): 205-219 |
| Mann S., Sipka A.S., Grenier J. The degree of postpartum metabolic challenge in dairy cows is associated with peripheral blood mononuclear cell transcriptome changes of the innate immune system. *Developmental and Comparative Immunology* (2019) Apr (93): 28-36 |
| Newman A, Miller D., Bitsko E., Leal Yepes F.A., Nydam D.V., Mann S. The effect of the transition period and postpartum body weight loss on macrophage infiltration in bovine subcutaneous adipose tissue. *Journal of Dairy Science* (2019) 102 (2): 1693-1701 |
| Mann S., Sipka A.S., Leal Yepes F.A., Nydam D.V., Overton T.R., Wakshlag J.J. Nutrient sensing kinase signaling in bovine immune cells is altered during the postpartum nutrient deficit: a possible role in transition cow inflammatory response*. Journal of Dairy Science* (2018) 101 (10): 9360-9370  |
| Mann S., Leal Yepes F., Wakshlag J.J, Behling-Kelly E., McArt J.A.A. The effect of different treatments for early lactation hyperketonemia on liver triglycerides, glycogen, and expression of key metabolic enzymes in dairy cattle. *Journal of Dairy Science* (2018) 101 (2): 1626-1637 |
| Mann S., Leal Yepes F.A., Behling-Kelly E., McArt J.A.A. The effect of different treatments for early lactation hyperketonemia on blood ß-hydroxybutyrate, plasma NEFA, glucose, insulin, glucagon in dairy cattle. *Journal of Dairy Science* (2017) 100 (8): 6470-6482 |

Future Research Direction Related to W3173:

* Continue work on colostrum components and impact of management strategies on immune response of newborn calves
* Include the effect of metabolic stress and hypocalcemia on immune response of postpartum cows and evaluate effects of supplementation of amino acids and Ca on immune response

# W3173 2020 – Research Overview

**Station (University/Organization):**

* University of Puerto Rico, Mayagüez Campus

**Researcher/ Research Team *(Name and e-mail)*:**

* Abner A Rodríguez-Carías, Abner.rodriguez3@upr.edu
* John Fernández-Van Cleve john.fernandez1@upr.edu

**Primary Research Interests and Objectives related to W3173:**

* Determine the performance, carcass traits and meat quality of native lambs raised under heat stress conditions
* Evaluate the reproductive performance of rams and ewes raised under heat stress conditions
* Measure pgysiological parameters (rectal temperature, respiration rate and heart rate) associated with heat stress in sheep amnd goats raised under heat stress (ITH > 78)

**Impact Statement for Primary W3173 Research (will be template for impact writing workshop):**

The main goal of our current work is to expand our understanding of the effects of heat stress on sheep and goat productive and reproductive performance

Experiments have shown that semen quantity and quality of rams raised under heat stress conditions was affected by season of the year and time (am or pm) of the day. Reproductive performance of ewes raised under heat stress was similar in short or long breeding seasons (34 versus 51 d).

Native crossbred sheep feeding total mixed ratios are capable to consume of 4% total body weight (dry matter basis) under heat stress conditions. Adding fat sources to the diet (4% DMD) did not improve physiological parameters values associated with heat stress in lambs. Diets with higher energy density did not improved the productive performance, carcass yield or retail cuts of native lambs, however, It was possible to obtain optimal daily gains (200g/d) and feed efficiency ratio (4:1). Carcass characteristics, cut yield and meat quality of lambs was not affected when fed two total digestible nutrient levels.

The physiological parameters associated with heat stress in native and pygmy goats raised under tropical climates were compared. The physiological parameters of lambs, ewes and rams raised under tropical climates were established. Selected appropriate small ruminant animal types (goat and sheep) might be more tolerant to the tropical environment heat stress than large ruminants.

**Researcher / Research Team Related Publications (last 3 years):**

* <https://scholar.uprm.edu/handle/20.500.11801/2535>

 Evaluación de suplementos de grasas inertes ruminales en la dieta de ovinos sobre el consumo y digestibilidad de nutrientes, parámetros fisiológicos y componentes sanguíneos . Benabe-Carlo, Elba G. (2018-12-11).

* <https://scholar.uprm.edu/handle/20.500.11801/1828>

Efecto del sistema de alimentación sobre parámetros productivos y fisiológicos de corderos criados en estrés por calor . Suárez-Rodríguez, José (2019-05-15).

* <https://scholar.uprm.edu/handle/20.500.11801/1/discover?scope=%2F&query=jomar+rosado&submit=>

Ganancia en peso, características de la canal y calidad de la carne de ovinos criollos alimentados en confinamiento con raciones totales. Rosa-Huertas, Jomar (2019-12-12)

* <https://scholar.uprm.edu/handle/20.500.11801/2621>

Rendimiento productivo, características de la canal y cortes y calidad de carne de corderos alimentados con dietas isonitrogenadas con dos niveles de nutrientes digeribles totales. Rios-Lugardo, Andrea (2020-05-05)

* Rodríguez-Carías, A.A, and J. Fernández Van Cleve. 2019. Evaluating a protocol for fixed time artificial insemination using two progesterone implants in crossbred ewes raised under heat stress. [The Journal of Agriculture of the University of Puerto Rico Vol. 103 No. 1 (2019): Vol. 103, No. 1, 2019](https://revistas.upr.edu/index.php/jaupr/issue/view/2306)
* Suarez, J., J. Collazo, A.A Rodriguez, and J.Fernandez. 2019. Physiological and productive parameters of Katahdin lambs fed with total mixed rations and raised under heat stress. XI Congress of the Latin American Association of Specialists in Small Ruminants and South American Camelids (ALEPRyCS). Queretaro, Mexico. Rev. Acad. Ciênc. Anim. 2019;17(Supl 1):223. ISSN: 2596-2868
* Suarez, J., J. Collazo, A.A Rodriguez, and J.Fernandez. 2019. Physiological parameters, weight gain, and carcass yield of crossbred lambs grazing naturalized pastures under heat stress. XI Congress of the Latin American Association of Specialists in Small Ruminants and South American Camelids (ALEPRyCS). Queretaro, Mexico. Rev. Acad. Ciênc. Anim. 2019;17(Supl 1):222.. ISSN: 2596-2868
* Collazo, J., J. Suárez, J. Hernández, R. Rodríguez, J. Fernández y A.A. Rodríguez. 2018. Parámetros fisiológicos, ganancia de peso vivo y rendimiento de la canal de ovinos criollos criados en pastoreo de pasturas naturalizadas bajo condiciones de estrés térmico. Memories. XXVI Meeting, Latinamerican Society of Animal Production, Guayaquil, Ecuador. OC42, P142
* Rodríguez Carías, A.A., V. Morales,, E. Benabe, L. C Solórzano y J. Fernández. 2018. Efectos de la inclusión de tres grasas inertes en el rumen en la dieta de corderos expuestos a estrés calórico sobre el consumo de materia seca y agua, digestibilidad de nutrientes y parámetros fisiológicos. Memories. XXVI Meeting, Latinamerican Society of Animal Production, Guayaquil, Ecuador. OC09, p. 140

**Future Research Direction Related to W3173**:

* Determine growth characteristics, puberty, and sexual maturity of male lambs progeny of male crosses Dorper and Katahdin with native ewes raised under heat stress conditions.
* Compare rectal temperature and thermographic points as a tool to determine heat stress in growing male and ewe lambs.

# W3173 2020 – Research Overview

Station (University/Organization):

* Oregon State University – Eastern Oregon Agricultural Research Center (EOARC, Burns)

Researcher/ Research Team *(Name and e-mail)*:

* Juliana Ranches, juliana.ranches@oregonstate.edu

Primary Research Interests and Objectives related to W3173:

* *Interest:* Nutritional strategies to reduce stress factors aimed to improve health and well-being of beef cattle.

*Objective:* To evaluate the effects of trace mineral supplementation of calves prior to weaning, on calf performance and health in order to reduce stress associated with weaning aiming to improve performance, health and well-being.

*Objective:* To evaluate the use of alternative methods for trace mineral delivery (injections) at specific times, aimed to improve cow-calf health, performance , and well-being.

* *Interest:* Management strategies to reduce stress factors aimed to improve health and well-being of beef cattle.

*Objective:* To understand and evaluate the effects of virtual fence use on cattle behavior, performance, and welfare, in order to develop management guidelines for this technology.

Impact Statement for Primary W3173 Research (will be template for impact writing workshop):

With growing consumer interest on ranching practices, specifically related to animal health and welfare, research to reduce stressors and improve health and welfare of livestock is demanding. Nutritional strategies such as the supplementation of trace minerals have major role on animal health and welfare, therefore the primary goal of this work is to evaluate the use of trace mineral supplementation at different levels and forms in order to improve cattle performance, health and welfare.

More specifically to the welfare area, new technologies are rapidly becoming available in the livestock industry such as the virtual fence, however, the effects of such technologies on animal performance, health, and welfare are not fully known. Therefore, it is vital to understand the effects of the use of such technology on cattle performance, health, and welfare in order to properly provide guidance for technology use.

Researcher / Research Team Related Publications (last 3 years):

* **Ranches**, J. , R Alves, M. Vedovatto, E. Anne Palmer, P. Moriel,and J. Arthington. 2021. Use of Radio-Frequency Identification Technology to Assess the Frequency of Cattle Visits to Mineral Feeders. *Under Review*
* **Ranches,** J.,R. A. De Oliveira, M. Vedovatto, E. A. Palmer, P. Moriel,L.D. Silva, G. Zylberlicht, J. S. Drouillard, and J. D. Arthington.2021. Low moisture, cooked molasses blocks: a limited intake method for supplementing trace minerals to pre-weaned calves. *Under Review*
* **Ranches,** J. , R Alves, M. Vedovatto, E. Anne Palmer, P. Moriel,and J. Arthington. 2021.Differences in copper and selenium metabolism between Angus (*Bos taurus*) and Brahman (*Bos indicus*) cattle. *Under Review*
* Moriel, P., Vedovatto, M., Palmer, E. A., Oliveira, R. A., Silva, H. M., **Ranches, J.,** Vendramini, Joao M. B. 2020. Maternal supplementation of energy and protein, but not methionine hydroxy analog, enhanced postnatal growth and response to vaccination in Bos indicus-influenced beef offspring. *J. Anim. Sci. 98*(5).
* Moriel, P., L. F. A. Artioli, M. B. Piccolo, M. Miranda, **J. Ranches**, V. S. M. Ferreira, L. Q. Antunes, A. M. Bega, V. F. B. Miranda, J. F. R. L. Vieira, and J. L. M. Vasconcelos. 2019. Effects of low-moisture, sugarcane molasses-based block supplementation on growth, physiological parameters, and liver trace mineral status of growing beef heifers fed low-quality, warm-season forage. *Trans. Anim. Sci.* 1–10. doi:10.1093/tas/txy123
* Moriel, P., G. M. Silva, M. B. Piccolo, **J. Ranches,** J. M. B. Vendramini, and J. D. Arthington. 2018. Supplementation of encapsulated cinnamaldehyde and garlic oil on pre- and post-weaning growth performance of beef cattle fed warm-season forages. *Prof. Anim. Sci*. 34:275-283. doi.org/10.15232/pas.2017-01707
* Silva, G. M., M. H. Poore, **J. Ranches,** G. S. Santos, and P. Moriel. 2018a. Effects of gradual reduction in frequency of energy supplementation on growth and immunity of beef steers. J*. Anim. Sci.* 96:273–283. doi:10.1093/jas/skx047.
* Silva, G. M., M. H. Poore, **J. Ranches**, G. S. Santos, and P. Moriel. 2018b. Effects of timing of vaccination relative to weaning and post-weaning frequency of energy supplementation on growth and immunity of beef calves. *J. Anim. Sci.* 96:318–330. doi:10.1093/jas/skx047.

Future Research Direction Related to W3173:

* Evaluation of different levels of trace mineral supplementation to calves prior to weaning.
* Effects of trace mineral injections on measures of performance and trace mineral status of heifers and their calves.
* Evaluation of GPS-activated shock collars (virtual fence) use on calf performance, behavior, and welfare.

# W3173 2020 – Research Overview

Station (University/Organization):

* The Ohio State University- Wooster Ohio

Researcher/ Research Team *(Name and e-mail)*:

* Dr. Anthony Parker, parker.1203@osu.edu
* Dr. Alejandro Relling, relling.1@osu.edu

Primary Research Interests and Objectives related to W3173:

* Understand the physiology and behavoir of cattle to stressors in their lifecycle. To investigate options to minimize or eliminate stressors on cattle and improve body weight growth and carcass characteristics.
* Understand the response of beef cattle to stress induced by climate change and investigate methods to help cattle producers to adapt and minimize these stressors on cattle.
* Understand the effects of the hypothalamo-pituitary-adrenal axis on growth and metabolism of ruminants.

Impact Statement for Primary W3173 Research (will be template for impact writing workshop):

Society’s continual push for improvements in the welfare of food producing animals has raised the standards expected of our farmers to operate an animal production business. Beef cattle and other grazing ruminants face many stressors throughout their life and understanding how grazing animals adapt to their environment and individual stressors can assist with better management decisions that can minimize the effects of a stressor and maximize production. In addition, our goal is to better understand the effects of environmental stress associated with climate change. In particular the increase in intense rainfall events in winter and spring and the drier and hotter summers expected for the Midwest USA.

Researcher / Research Team Related Publications (last 3 years):

* Nickles, K.R., Relling, A.E., Moraes, L.E. and Parker, A.J. 2020. The effect of a social facilitator cow on the distance walked and time spent walking by abruptly weaned beef calves. Animal Production Science. Accepted for Publication on 25 November 2020.
* Wagner, B.K., Relling, A.E., Kieffer, J.D., Moraes, L.E. & Parker A.J. 2019.Short Communication: Pharmacokinetics of oxytocin administered intra-nasally to beef cattle. Domestic Animal Endocrinology. <https://doi.org/10.1016/j.domaniend.2019.106387>
* Wagner, B.K., Relling, A.E., Kieffer, J.D., and Parker A.J. 2019. Intranasal oxytocin treatment does not attenuate the hypothalamo-pituitary-adrenal axis in beef heifers subjected to isolation stress or restraint and isolation stress. Domestic Animal Endocrinology. <https://doi.org/10.1016/j.domaniend.2019.07.007>
* Leo-Penu, C.L.O., J. Picard, L.A. Fitzpatrick and A.J. Parker. 2018. Feed and water deprivation has a negative but transient effect on the rumen kinetics of *Bos indicus* steers. Journal of Animal Physiology and Animal Nutrition. 00:1-9. <https://doi.org/10.1111/jpn.12877>

Future Research Direction Related to W3173:

* Investigate the effects of mud on spring calving beef cattle herds. Determine the energetic cost of mud to gestating cow and heifer herds. Determine the options available for attenuating the effects of mud on gestating beef cow herds
* Determine the behavioural and physiological response of cattle and sheep to individual stressors.

# W3173 2020 – Research Overview

Station (University/Organization):

* University of Arizona, Tucson

Researcher/ Research Team *(Name and e-mail)*:

* Benjamin Renquist, bjrenquist@email.arizona.edu
* Duarte Diaz, duartediaz@arizona.edu

Primary Research Interests and Objectives related to W3173:

* Developing a mouse model to recapitulate the decreased food intake and milk production in heat exposure.
* Understand the role of histamine signaling and resulting decrease in digestive tract and mammary gland blood flow in the hypophagia and hypogalactia of heat stress
* Dietary additives on heat stress mitigation in Dairy Cattle
* Physiological impacts of heat stress in Beef Cattle
* Extension delivery of heat stress mitigation programs fro Beef and Dairy

Impact Statement for Primary W3173 Research (will be template for impact writing workshop):

 The depressed production resulting from heat exposure is becoming ever more important with increasing global temperatures. The increased consumer demand for sustainable animal products requires that animal agriculture producers optimize production while limiting the use of water and energy. By understanding the physiological mechanism by which heat suppresses food intake, growth, and milk production our research aims to identify pharmacological or genetic targets to increase production while limiting the use of resources.

Researcher / Research Team Related Publications (last 3 years):

Beckett, L., Rosemond, R., Renquist, B., & White, R. (2018). Evaluating a novel strategy for measuring basal metabolic rate of bovine skeletal muscle. Journal of Animal Science, 96, 47-48.

Beckett, L., Rosemond, R., Renquist, B., & White, R. (2019). A muscle biopsy technique for stratifying cattle by skeletal muscle metabolic activity. Journal of dairy science, 102(4), 3136-3141.

Collier, R. J., Renquist, B. J., & Xiao, Y. (2017). A 100-Year Review: Stress physiology including heat stress. Journal of dairy science, 100(12), 10367-10380.

Diaz, D., Vander Poel, M., Xiao, Y., Renquist, B., Wright, A., Collier, R., & Compart, D. (2018). Environmental chamber heat stress responses and adaptations in crossbred Hereford steers. Translational Animal Science, 2(suppl\_1), S185-S188.

Geisler, C., & Renquist, B. (2020). The Role of GPR109a Signaling in Niacin Induced Effects on Fed and Fasted Hepatic Metabolism.

Geisler, C. E., Ghimire, S., Bogan, R. L., & Renquist, B. J. (2019). Role of ketone signaling in the hepatic response to fasting. American Journal of Physiology-Gastrointestinal and Liver Physiology, 316(5), G623-G631.

Geisler, C. E., Kentch, K. P., & Renquist, B. J. (2017). Non-mammalian vertebrates: distinct models to assess the role of ion gradients in energy expenditure. Frontiers in endocrinology, 8, 224.

Renquist, B. J. (2018). Methods and systems for measuring growth rate in plant or aquatic animal species. In: Google Patents.

Renquist, B. J. (2019). Invited Review: Hypophagia and hypogalactia associated with heat stress. Applied Animal Science, 35(1), 49-56.

Renquist, B. J. (2020). Methods for measuring reducing equivalent production by tissues to determine metabolic rates and methods of use. In: US Patent App. 16/875,775.

Vander Poel, M. J. (2019). Implications of Feed Additives in the Mitigation of Heat Stress in Cattle.

Xiao, Y., Kronenfeld, J. M., & Renquist, B. J. (2020). Food intake dependent and independent effects of heat stress on lactation and mammary gland development. bioRxiv.

M. Vander Poel, R. Collier, B. Renquist, Y. Xiao, D.E. Diaz. (2020) Evaluation of lactating Holstein cows during heat stress in response to a dietary feed additive in mid lactation. Journal of Dairy and Veterinary Sciences. 14(5), 2573-2196.

R.R. Reith, R.L. Sieck, P.C. Grijalva, E.M. Duffy, R.M. Swanson, A.M. Fuller, K.A. Beede, J.K.Beard, D. E. Diaz, T.B. Schmidt, D.T. Yates, J. L. Petersen. Heat stress and beta-adrenergic agonists alter the adipose transcriptome and fatty acid mobilization in ruminant livestock. Translational Anim. Sci. 2020

Future Research Direction Related to W3173:

 Dr. Renquist will continue studies aimed at understanding the signals that initiate changes in blood flow to the GI tract and mammary gland in mice. Translation to production species will be conducted in conjunction with Dr. Duarte Diaz.

 Dr. Diaz will continue studies aimed at applied heat stress mitigation in both Beef and Dairy cattle. His team will also continue the delivery of results through extension programs throughout the state.

# W3173 2020 – Research Overview

Station (University/Organization):

* University of Maryland

Researcher/ Research Team *(Name and e-mail)*:

* Shawna Weimer, slweimer@umd.edu

Primary Research Interests and Objectives related to W3173:

* Current research in the Weimer lab seeks to identify the impact of nature (breed) and nurture (husbandry practices) on key physiological and behavioral indicators of broiler health and welfare. Specifically, through projects focused on determining the contribution of growth rate, disease, and heat stress on broiler chicken health, stress, and welfare.

Impact Statement for Primary W3173 Research (will be template for impact writing workshop):

Sustainable agricultural production systems with animal producers that adopt husbandry practices and raise animals in housing facilities that are acceptable to the public. However, there can be discrepancies between public perception and the actual welfare conditions of production systems that are often considered more welfare-friendly than others. Through basic and applied research, our mission is to identify the contribution of genetics and environment on poultry welfare.

Researcher / Research Team Related Publications (last 3 years):

* Weimer, S. L., A. Mauromoustakos, D. M. Karcher, and M. A. Erasmus. 2020. Differences in performance, body conformation, and welfare in conventional and slow-growing broilers raised at 2 stocking densities. Poultry Science. 99:4398-4407. DOI: 10.1016/j.psj.2020.06.009.
* Weimer, S., R. Wideman, C. Scanes, A. Mauromoustakos, K. Christensen, and Y. Vizzier-Thaxton. 2020. Broiler stress responses to light intensity, flooring type, and leg weakness as assessed by heterophil-to-lymphocyte ratios, serum corticosterone, infrared thermography, and latency to lie. Poultry Science. 99:3301-3311. DOI: 10.1016/j.psj.2020.03.028.
* Weimer, S. L., C. I. Robison, R. J. Tempelman, D. R. Jones, and D. M. Karcher. 2019. Laying hen production and welfare in enriched colony cages at different stocking densities. Poultry Science. 98:3578-3586. DOI: 10.3382/ps/pez107.
* Weimer, S. L, R. Wideman, C. Scanes, A. Mauromoustakos, K. Christensen, and Y. Vizzier-Thaxton. 2019. The utility of infrared thermography for evaluating lameness attributable to bacterial chondronecrosis with osteomyelitis. Poultry Science. 98:1575-1588. DOI: 10.3382/ps/pey538.
* Weimer, S. L., R. F. Wideman, C. G. Scanes, A. Mauromoustakos, K. D. Christensen, and Y. Vizzier-Thaxton. 2018. An evaluation of methods for measuring stress in broiler chickens. Poultry Science. 97:3381-3389. DOI: 10.3382/ps/pey204.
* Weimer, S., T. J. Fangman, L. A. Karriker, K. J. Stalder, and A. K. Johnson. 2018. Nursery pig behavior evaluation pre- and post injection using digital-image methodology. Journal of Swine Health and Production. 26:25-33.

Future Research Direction Related to W3173:

* Develop algorithms to detect and predict broiler chicken health and behavior using deep learning neural network computer vision models.

# W3173 2020 – Research Overview

Station (University/Organization):

* University of Minnesota

Researcher/ Research Team *(Name and e-mail)*:

* Yuzhi Li (yuzhili@umn.edu)

Primary Research Interests and Objectives related to W3173:

* Swine Behavior and Welfare: Development of tail biting (social network analysis, optical flow), Grimace scale to measure pain caused by castration in piglets (related to W3173 Objective 1: Identify meansures of animal stress and well-being and characterize factors affecting the biology of stress and immune responses)
* Swine housing systems and management: Group housing of sows, Organic swine production systems, Floor cooling/chilled drinking water for lactating sows and floor warming for suckling piglets via solar energy (related to W3173 Objective 3: Development of management strategies and/or tools to enhance farm animal well-being under conditions of climate change or other stressful environments)

Impact Statement for Primary W3173 Research (will be template for impact writing workshop):

Our research provides novel tools for farners to identify and prevent pain in pigs, to minimize social stress in group-housed sows, and to alleviatet thermal stress in lactating sows and sckling piglets using renewable energy. Using these tools, swine producers will be able to enhance animal well-being while minimizing environmental impacts of swine production.

Researcher / Research Team Related Publications (last 3 years):

* Lou, M., B. Ventura, J. Deen, and **Y. Z. Li.** Surgical castration changes struggle behavior and vocalizations in male piglets. Submitted to J. Appl. Anim. Welf. Sci.
* Y. Zhu, L. J. Johnston, M. Reese, E. Buchanan, J. Tallaksen, A. Hilbrands, and **Y. Z. Li.** Effects of cooled floor pads combined with chilled drinking water on behavior and performance of lactating sows under heat stress. Submitted to J. Anim. Sci.
* Zhu, Y., **Y. Z. Li,** M. Reese, E. Buchanan, J. Tallaksen, and L. J. Johnston. 2020. Behavior and performance of suckling piglets provided three supplemental heat sources. *animals.* 2020, 10, 1155/doi:10.3390/ani10071155.
* **Li, Y. Z.,** L. J. Johnston, and M. S. Dawkins. 2020. Utilization of optical flow algorithms to monitor development of tail biting outbreaks in pigs. *animals.* 2020, 10, 323/doi:10,3390/ani10020323.
* **Li, Y. Z.,** S. Q. Cui, X. J. Yang, L. J. Johnston, and S. K. Baidoo. 2018. Minimal floor space allowance for gestating sows kept in pens with electronic sow feeders on fully slatted floors. J. Anim. Sci. Vol. 96 (10): 4195-4208
* **Li, Y. Z.,** H. Zhang, L. Johnston, and W. Martin. 2018. Understanding tail-biting in pigs through social network analysis. *animals.* 8 (1)13: 1-13 /doi:10.3390.ani8010013.

Future Research Direction Related to W3173:

* Depending on the funding availability in the future, we would like to:
	+ Validate sensors that could accurately and effectively monitor individual pigs (location and activity) in a group (W3173 Objective 1).
	+ Refine grimace scale to measure pain in pigs (W3173 Objective 1).
	+ Continue to investigate the development of tail biting and strategies to prevent tail biting without tail docking (W3173 Objectiveas 1 and 3).
	+ Enhance animal well-being in organic swine production systems by identifying/monitoring compromised pigs in large groups (Objective 3).

# W3173 2020 – Research Overview

Station (University/Organization):

* University of the Virgin islands

Researcher/ Research Team *(Name and e-mail)*:

* Bob Godfrey, rgodfre@uvi.edu

Primary Research Interests and Objectives related to W3173:

* Our main objective has been to study physiology of heat stress in hair sheep in the tropical environment by monitoring ewe body temperature throughout the production cycle.

Impact Statement for Primary W3173 Research (will be template for impact writing workshop):

Evalauting the ability of local breed sof hair sheep to tolerate the hot, humid tropical climate will provide information that can be used when developing breeding programs to select for heat tolerance traits as we deal with climate change.

Researcher / Research Team Related Publications (last 3 years):

* Godfrey, R.W., W.D. Preston, S.R. Joseph, L. LaPlace, P.E. Hillman, K.G. Gebremedhin, C.N. Lee, and R.J. Collier. 2017. Evaluating the impact of breed, pregnancy and hair coat on body temperature and sweating rate of hair sheep ewes in the tropics. J. Anim. Sci. 95:2936-2942. doi:10.2527/jas2016.1125
* Godfrey, R.W., S.A. Lakos and S.R Joseph. 2018. The effect of water restriction at weaning on hair sheep ewes and lambs in the tropics. J. Anim. Sci. 96(Suppl. 1):66 doi.org/10.1093/jas/sky027.124
* Godfrey, R.W., A.L. Nero G. Roberts, and S.A. Lakos. 2018. Evaluating the lag between body temperature and ambient temperature in hair sheep ewes in the tropics. J. Anim. Sci. 96(Suppl. 3):382-383 <https://doi.org/10.1093/jas/sky404.839>
* Godfrey, R.W., A.L. Nero and S.A. Lakos. 2019. A comparison of body temperature among pregnant, non-pregnant and lactating hair sheep ewes in the tropics. J. Anim. Sci. 97(Suppl. 3):169–170, <https://doi.org/10.1093/jas/skz258.349>

Future Research Direction Related to W3173:

* Our sheep are managed in an accelerated lamenting system (3 lamb crops in 2 years) so we will be able to evaluate body temeparture ewes at different stages of the production cycle at different times of the year. We will compare our St Croix White to Doper x St Croix white ewes. Temperature data loggers will be used to monitor vaginal temperature as an indicator of core body temperature for 1 week each month through the 8 month production cycle over a 2 year period.

# W3173 2020 – Research Overview

Station (University/Organization):

* University of Nebraska-Lincoln

Researcher/ Research Team *(Name and e-mail)*:

* Jessica Petersen, jessica.petersen@unl.edu
* Dustin Yates, dustin.yates@unl.edu
* Ty Schmidt, ty.schmidt@unl.edu

Primary Research Interests and Objectives related to W3173:

* By studying the physiological and genomic responses to stress as well as the resulting impact on growth, body composition, and carcass charcateristics, we seek to elucidate the independent and combined effects of stressors (heat stress) and β-adrenergic agonist (βAA) supplementation on ruminant livestock.
* We seek to characterize the role of differing mtDNA genotypes on mitochondrial stress in muscle stem cells of various mammalian species and how this affects the mitochondrial reponses to βAA.
* We seek to understand the effect of maternofetal stress during critical windows of gestation on fetal programming of growth capacity and metabolic function. Specifically, we seek to better understand the changes to stress-responsive signaling pathways in muscle, fat, and pancreatic islets.
* We seek to better understand animal behavior through long-term AI tracking of livestock and zoo animals kept in confined areas. We ultimately expect to use AI-monitored behaviors to identify stress/health issues, determine social hierarchies, and estimate growth/body composition.

Impact Statement for Primary W3173 Research (will be template for impact writing workshop):

Mitigating stress and ensuring sound animal wellbeing is a priority for the livestock industry. With new challenges of a changing and unpredictable environment and a heightened demand for meat animal production, we have an opportunity to better understand the physiological means by which some breeds or individual animals tolerate stress more effectively than others, with an expectation that once differences in coping mechanisms are understood, producers can capitalize by using this information in their management decisions. The goal of our current work is to expand our understanding of the molecular and physiological mechanisms by which livestock respond to heat stress and to βAA supplementation, and how differences in these responses differentially affect animal wellbeing and production.

Researcher / Research Team Related Publications (last 3 years):

* Swanson RM, Tait Jr RG, Galles RM, Duffy EM, Schmidt TB, Petersen JL, Yates DT. 2020. Heat stress-induced deficits in growth, metabolic efficiency, and cardiovascular function coincided with chronic systemic inflammation and hypercatecholaminemia in ractopamine-supplemented feedlot lambs. J Anim Sci. 98:skaa168. 10.1093/jas/skaa168.
* Nilson SM, Workman AM, Sjeklocha D, Brodersen B, Grotelueschen DM, Petersen JL. 2020. Upregulation of the type I interferon pathway in feedlot cattle persistently infected with bovine viral diarrhea virus. Virus Res. 278:197862. 10.1016/j.virusres.2020.197862.
* Burrack RM, Duffy EM, Yates DT, Schmidt TB, Petersen JL. 2020. Whole blood transcriptome analysis in feedlot cattle after 35-days of supplementation with a β1-adrenergic agonist. J Applied Gen. 61:117-121. 10.1007/s13353-019-00527-6.
* Cadaret CN, Merrick EM, Barnes TL, Beede KA, Posont RJ, Petersen JL, Yates DT. 2019. Sustained maternal inflammation during the early third trimester yields intrauterine growth restriction, impaired skeletal muscle glucose metabolism, and diminished β cell function in fetal sheep. J Anim Sci. 97:4822-4833. 10.1093/jas/skz321.
* Barnes TB, Cadaret C, Beede K, Schmidt TB, Petersen JL, Yates DT. 2019. Hypertrophic muscle growth and metabolic efficiency were impaired by chronic heat stress, improved by zilpaterol supplementation, and not affected by ractopamine supplementation in feedlot lambs. J Anim Scie. 97:4101-4113. 1093/jas/skz271
* Beede KA, Limesand SW, Petersen JL, Yates DT. 2019. Real supermodels wear wool: summarizing the impact of the pregnant sheep as an animal model for adaptive fetal programming. Animal Frontiers. 9:34-43. 10.1093/af/vfz018.
* Beard JK, Mulliniks JT, Yates DT. 2019. Function and dysfunction of fatty acid mobilization: a review. Diabesity 5:1-5.
* Posont RJ and Yates DT. 2019. Postnatal nutrient repartitioning due to adaptive developmental programming. Vet Clin Food Anim 35:277-88.
* Yates DT, Petersen JL, Schmidt TB, Cadaret CN, Barnes TB, Posont RJ, Beede KA. 2018. Fetal origins of impaired muscle growth and metabolic dysfunction: lessons from the heat-stressed pregnant ewe. J Animal Sci. 96:2987-3002. doi: 10.1093/jas/sky164.

Future Research Direction Related to W3173:

* Utilizing a *Bos indicus* breed, replicate a prior live animal study to evaluate how genotype alters an individual’s response to heat stress and supplementation with βAA.
* Continue to evaluate how mtDNA genotype alters cellular response to mitochondrial stress and stimulation with βAA.