**APPENDIX D**

**SAES-422**

**Format for Multistate Research Activity**

**Accomplishments Report**

**Project/Activity Number: NRSP8**

**Project/Activity Title: Building Applied Genomic Capacity for Animal Industries**

**Period Covered: 10/2023-9/2024 (“Year 2”)**

**Date of This Report: 3/12/2025**

**Annual Meeting Date(s): 1/12/2025**

**Participants:** The annual meeting in January 2025 capped an active year for the NRSP8 leadership team, which held virtual meetings monthly to move initiatives forward. These virtual meetings were attended by the chairs and aim coordinators, administrative advisors, and USDA representatives (listed). The in-person leadership meeting on 1/13/25 was attended by most of these individuals (travel delays and health issues precluded some from attending) as well as some members of the external advisory board (see below).

|  |  |  |
| --- | --- | --- |
| **NAME** | **INSTITUTION/AFFILIATION** | **EMAIL** |
| Annette McCoy | U. of Illinois; *Chair* | [mccoya@illinois.edu](mailto:mccoya@illinois.edu) |
| Molly McCue | U. of Minnesota; *New Chair-Elect* | [mccu0173@umn.edu](mailto:mccu0173@umn.edu) |
| Benjamin Reading | NC State U; *Past Chair* | [bjreadin@ncsu.edu](mailto:bjreadin@ncsu.edu) |
| Daren Hagen | Oklahoma State; *Aim 1 Lead Coordinator* | [darren.hagen@okstate.edu](mailto:darren.hagen@okstate.edu) |
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| Rebecca Cockrum | Virgina Tech; *Aim 3 Lead Coordinator* | [rcockrum@vt.edu](mailto:rcockrum@vt.edu) |
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Later that afternoon, the general business meeting was held, and was attended by approximately 80 individuals representing many academic institutions, industry, and the USDA.

**Brief summary of minutes of annual meeting:** The meeting opened with an introduction of the leadership team and a review of the project aims. Chair Annette McCoy provided an overview of the ongoing work being spearheaded by the leadership team (see Accomplishments). This included introduction of the new External Advisory Board (EAB). Upcoming opportunities including a NRSP-8 sponsored workshop for summer 2025 and a summer fellowship stipend were announced. A keynote presentation was then given by Joan Lunney, a distinguished long-time member of the NRSP-8 community in which she highlighted the role that the program/community has played in her career. The ten students awarded NRSP-8 travel stipends presented lightning talks designed to encourage attendees to go to their poster sessions. This was followed by a panel discussion focused on transferable skills for careers in academia, industry, and government. Participants represented a wide range of career paths and stages (Travis Williams, Hy-Line International; Cary Knox, Interval Bio; Noelle Cockett, Utah State University; Kal Kalavacharla, USDA). A visioning talk was given by Ted Kalbfleisch, which focused on opportunities and challenges that lie ahead for the NRSP-8 community. Preliminary results from the stakeholder survey focused on educators was presented, and the three aim coordinators gave reports of aim-specific activities. Kal Kalavacharla provided a USDA update including upcoming calls for funding. Benjamin Reading presented an introduction to the upcoming third-generation USDA Blueprint, which will set a 10-year vision for advancing animal genomics research in the United States. A call for station reports was made. New co-coordinators and a new chair elect were selected from a slate of candidates made available before the meeting. Electronic voting was held open for 24 hours to accommodate NRSP-8 members that could not attend in person. The group moved, seconded, and unanimously approved a return to PAG in January 2026 for the next annual meeting. The meeting was then adjourned.

**Accomplishments:** NRSP-8, Building Applied Genomic Capacity for Animal Industries has three aims. Stations were asked to describe specific accomplishments related to these aims in their annual reports. These are highlighted below.

***AIM 1: Extending genomics capacity to a broader range of Animal Science stakeholders.***

* (Cornell) One of our lab projects is currently developing a large-scale comparative genomic analyses workflow that integrates transcriptomic data across multiple species to uncover the conserved gene networks regulating pluripotency. This work is directly aligned with NRSP8's Specific Aim 1: extending genomics capacity to a broader range of Animal Science stakeholders. We developed a comparative genomics approach that allows for the identification of shared regulatory mechanisms across species, a crucial step in applying genomic insights across different livestock animals. By understanding these conserved mechanisms, our work has the potential to inform a wide range of stakeholders, from researchers to those in the agricultural industry, about the fundamental biological processes that can be leveraged to improve livestock production and animal health.
* (Cornell) We shared our published results on transcriptomic changes in dairy cow liver under HS through platforms like Twitter (X), reaching a diverse audience. These findings, alongside insights from our broader research, were also presented at the Plant and Animal Genome (PAG) conferences in 2022 and 2024, with an additional invited talk scheduled for 2025. Moreover, we delivered three invited talks on this topic in 2023, engaging public and academic audiences.
* (Michigan State) Developed a survey on management practices adopted by beef cattle producers to be deployed across the US. The survey is to be released to producers in late January or early February 2025.
* (Kansas State) Kansas State University participated as a part of a multi-organization series of activities, called Catalyzing Across Sectors to Advance the Bioeconomy (CASA-Bio; www.casa-bio.net). CASA-Bio was inspired by the Executive Order on Advancing Biotechnology and Biomanufacturing Innovation for a Sustainable, Safe, and Secure American Bioeconomy) issued by the Biden White House in September 2022, which called in part for collaboration across government, industry, non- profits, and academia to identify key areas for foundational research and development needed to advance U.S. biotechnology and biomanufacturing in five areas: climate change solutions, food and agriculture innovation, supply chain resilience, human health, and cross-cutting innovations. The ideas contained in this report (authored by Mark E. Sorrells, Cornell University; Cedric Gondro, Michigan State University; Natalia De Leon, University of Wisconsin, Madison; Carlos Messina, University of Florida; Maci Mueller, Kansas State University; and Benjamin Reading, North Carolina State University) were informed by discussions at a CASA-Bio workshop, “Accelerated Breeding for All Economically Important Crops and Animals” that was held August 14-15, 2024. Casa-BIO AgSystems: Accelerated Breeding for a Resilient Bioeconomy Integrating advanced plant and animal breeding systems will transform agricultural productivity, sustainability, and climate resilience in the U.S. This proposed initiative will secure food supply chains, drive biotechnological innovation, and foster economic growth in biofuels and bioproducts.
* (Kansas State) Kansas State University’s 34th Annual Swine Profitability Conference: Over 175 swine producers, industry representatives, faculty, and students at Kansas State University’s 34th Annual Swine Profitability Conference. Featured speakers included Dr. Steve Meyer, Partners in Production Agriculture, Dr. Chad Mire, National Bio and Agro-Defense Facility, Dr. Marcelo Almeida, Iowa State University, Bryan Humphreys, National Pork Producers Council, and Dan Gerety, J-Six Farms. The current state of the U.S. swine industry was emphasized by the speakers, offering valuable perspectives for strategic business choices and exploring forthcoming prospects for swine farmers.
* (Kansas State) 2024 K-State Swine Day: Over 400 producers, along with industry representatives from 26 states. Additionally, numerous K-State students, faculty, and staff joined this year’s event. Throughout the day, attendees got to interact with the trade show which featured 36 exhibitors and 21 additional sponsors showcasing cutting-edge technology and talking about their companies. K-State faculty and graduate students presented updates on applied research, and the event concluded with an insightful presentation by Dr. Kyle Coble and PJ Corns on "Creating Opportunities in a Large Production System." Attendees not only enjoyed hearing about the story of their first meeting but also gained valuable insights on keeping employees motivated and focused on achieving their goals. The 2024 Swine Day report highlights 41 research papers summarizing 47 experiments involving 122,599 pigs.
* (Arkansas) Presented a workshop on genome sequencing and assembly for snake, scorpion and spider genomes at the Arkansas INBRE conference, November 2024. Attendees were faculty and students from colleges and universities in Arkansas and neighboring states.
* (North Carolina State) Conducting a postdoctoral collaboration to learn and develop capacity regarding research methodology and applications in livestock pan genomes. Developed a survey in collaboration with Dr. Antoin Alston entitled: Survey on Genomics Educational Needs in U.S. Land-Grant Universities” Participating in Bovine Pan Genome Consortium education and outreach
* (University of California-Davis) I am a co-PD on a 5-year, $5 million FDA Animal and Veterinary Innovation Center (AVIC) grant. The UC Davis Intentional Genomic Alteration Innovation Center will focus on genome editing of livestock like pigs, sheep and cattle to support science-based regulations that demonstrate the safety of the technology and pave the way for human consumption of edited animals. The overall objectives of this project are to advance the use of gene editing technologies in food animals, while generating and sharing both phenotypic and bioinformatic data with the FDA to support a science-based approach to the regulation of gene editing in food animals in USA. Started 9/15/2024-8/30/2029. (Maga (PD), Berger, Denicol, Van Eenennaam). Data being generated will be placed in public archive.
* (University of California-Davis) I spoke to researchers, producers and breed associations about our work at 35 presentations all over the world including invited presentations to both California and national audiences, and also New Zealand, Australia, and Ireland.
* (Minnesota) Horseracing Safety Integrity Authority and International Federation of Horseracing Authorities – discussed opportunities for genetics to reduce the frequency of exercising associated sudden death in Thoroughbred racehorses.
* (Minnesota) Minnesota Trotting Association – talked about arrhythmias and the genetics or arrhythmias in racing Standardbreds.
* (Minnesota) I was part of a panel that discussed genetic testing and the importance of thorough validation of diagnostic tests at the American College of Veterinary Internal Medicine annual forum in Minneapolis, MN.
* (Pennsylvania State) The Liu lab has built up a broader range of scientists from academia and cattle industry to work on the bovine testis development and male fertility, with a goal to illustrate transactional regulation of testis development and spermatogenesis and to build a testis GTEx project.
* (Pennsylvania State) The Kim lab has been developing in vitro resources to enable functional studies of the chicken genome by leveraging CRISPR-based technologies, and sharing these resources with the research community. Currently, we have engineered three different chicken cell lines (DF1 fibroblast, DT40 B cell, and LMH liver epithelial) to express CRISPR activation (CRISPRa) and CRISPR interference (CRISPRi) systems for gene activation and repression, respectively. These cell lines, plasmids, and protocols are available for sharing with the broader research community.
* (Pennsylvania State) Work with the AI industry, such as Select Sires and Neogen, and research institutions across the nation (see collaboration above) and built up a team for cattle male fertility genomic research.
* (Iowa) Development of data analysis methods that allow data sharing but protect the intellectual property investments of breeding companies. Breeding companies are willing to share genomic data for academic research but need to protect their research investments in genomics data that gives them a market advantage over their competitors. Research in agricultural genome to phenome (AG2P) research to link genes and their function to important agricultural traits benefits greatly from access to industry data. With the long-term goal of enabling efficient and effective AG2P research and applications to advance livestock and crop production, this project seeks to develop the following multifaceted strategy: (1) fostering streamlined data sharing of public data, (2) innovating data sharing methods that protect confidentiality, and (3) enabling collaborative research without data sharing. (4) delivering educational resources on effective data sharing and collaboration in AG2P. The expected outcomes are platforms and methods for data sharing and collaboration using both public and confidential data.
* (Iowa) Development of new big data methods to improve our understanding of how genetics can be used to breed for more efficient growing pigs in different environments. Current genomic prediction methods are based on empirical linear 'black-box' approaches that typically provide useful predictions for the conditions (genetic and environmental) that prevail in the training data but suffer from poor extrapolation to other conditions. This project developed a new genomic evaluation approach that integrates biological models called the Pig-Growth-Model Whole Genome Prediction. A new Bayesian Hierarchical model was developed to integrate a mechanistic growth model developed for diet formulation into methods for genomic prediction in grow-finish pigs.
* (Hawaii) To understand the current state of Hawaii's cattle industry and how genetic approaches could address industry challenges, I launched a statewide survey targeting all farmers and ranchers. This survey aims to gather information on current cattle breeding practices. In my role as coordinator-elect for NRSP8 Aim 3, I distributed two stakeholder surveys within our department and college. I also met with several faculty members to discuss their research needs related to genomics and any challenges they face in this area.
* (Hawaii) During the Fall of 2024, I participated in the Hatch Blue program, where I connected with aquaculture farmers and entrepreneurs. I toured various farms and businesses, gaining firsthand experience with the production of diverse species, including fish, shrimp, seaweed, and algae.
* (Florida) Stakeholder presentations:

1. Kentucky Equine Research: 27th Equine Health and Nutrition Conference, Ocala FL, February 5-6, 2024 – “Should You Sweat It? Anhidrosis in the Equine Athlete”

2. Equine Affaire, Columbus OH, April 11th 2024 – “DNA & Genetic Testing Isn’t Just for Breeders: Get a Leg Up on Genetics, Tips for Horse Owners”

3. Equine Affaire, Columbus OH, April 12th 2024 – “Galloping into the Future: What’s Next for Equine Genomics, Recent Discoveries and Cutting Edge Applications”

4. 2024 Al Khamsa Annual Meeting and Convention, Online, June 15th 2024 – “DNA 101: Genetic Profiling, what is it?”

5. American Trakehner Association, 2024 Annual Meeting, Ocala FL, December 20th 2024 –

6. In addition to the presentations listed above, I’m also an advisor to the APHA Breed Integrity Committee, and do several interviews in industry publications each year:

7. Interviewed in: “How Coat Color and Genetics Influence Equine Behavior” by Sarah Welk Baynum, The Horse, (USA National, March 8, 2024), https://thehorse.com/1125641/how-coat-color-and-genetics-influence-equine-behavior/

8. Interviewed in: “Handling and Training Donkeys” by Haylie Kerstetter, The Horse, (USA National, August 8, 2024), https://thehorse.com/1122463/handling-and-training-donkeys/

* (Aquaculture – Multiple Stations) Benjamin Reading served as one of the National Co-Chairs for Catalyzing Across Sectors to Advance the Bioeconomy (CASA-Bio), along with Cendric Gondro and Maci Meuller from the NRSP-8. The CASA-Bio Accelerated Breeding for All Economically Important Crops and Animals Advancement Workshop was conducted on August 12-16, 2024 in response to Presidential Executive Order (EO) 14081 Advancing Biotechnology and Biomanufacturing Innovation for a Sustainable, Safe, and Secure American Bioeconomy). The CASA-Bio report was made publicly available by the Office of Science Technology and Policy in fall 2024 and outlines an entirely new kind of science in plant and animal research—this will help to form the basis of the new USDA Blueprint (2028-2037).
* (Aquaculture – Multiple Stations) Benjamin Reading is Co-Coordinator of the National Program for Genetic Improvement and Selective Breeding for the Hybrid Striped Bass Industry, a national consortium of academic, government, and industry collaborators dedicated to improving hybrid striped bass aquaculture through selective breeding and domestication. The Pamlico Aquaculture Field Laboratory (Aurora, NC) is the sole world source of these domestic fish. Hundreds of different striped bass and white bass families are being bred at this site annually and we have disseminated thousands of broodstock fish to commercial hybrid striped bass farmers in North Carolina and South Carolina since 2015; an equivalent number of broodstock animals were distributed throughout the Midwest from the USDA ARS Harry K. Dupree Stuttgart National Aquaculture Research Center, who are official collaborators in this endeavor.
* (North Carolina A&T) Conducting a postdoctoral collaboration to learn and develop capacity regarding research methodology and applications in livestock pan genomes. Developed a survey in collaboration with Dr. Antoin Alston entitled: Survey on Genomics Educational Needs in U.S. Land-Grant Universities” Participating in Bovine Pan Genome Consortium education and outreach.

***AIM 2: Supporting capacity to integrate genomic and biological data.***

* (Cornell) Since 2022, I have designed and taught a new course, Animal Genomics and Epigenomics, which provides a foundation in functional genomics, epigenomics, and basic bioinformatics. The course is designed to equip students with advanced techniques and tools in genomics and their applications in animal biology, health, and production. The course consists of weekly lectures covering basic concepts and weekly workshops (computer labs or journal discussions). Workshops consist of exercises and discussions to provide students with hands-on experience performing basic genomic analyses. Students will become familiar with the NCBI, UCSC genome browser, databases, and basic bioinformatic tools. Students will work in groups on a final project and develop research goals to study the function(s) of a specific gene of interest.
* (Kansas State) CASA-Bio workshop, “Accelerated Breeding for All Economically Important Crops and Animals” that was held August 14-15, 2024
* (Arkansas) Member of program steering committe for the AR-BIC (Arkansas Bioinformatics Consortium) conference for 2024 and 2025
* (North Carolina State) Attended SAS Viay workshop July 17 2024. SAS Scientists, student’s postdoctoral scientists and PD are engaged in collaborative data analysis. Sheep and goat phenotypic and genotypic data were analyzed to predict the impact environment has on gastrointestinal parasite levels on pasture in St Croix sheep that are parasite resistant and susceptible Boer goat crosses. Machine learning approaches are being investigated. In cows Cytometricic data and EVOS imaging are being used to assess Netosis in blood and milk.
* (Iowa) Development of high-throughput phenotyping strategies and big data approaches to improve disease resilience in pigs. Disease represents one of the largest economic cost components to the U.S. swine industry. The objectives of this study were to develop automated methods based on machine learning for early detection of disease in nursery pigs using daily feeding and drinking behavioral pattern data, along with body weight. Outcomes from this research include automated early detection of disease in individual grow-finish pigs using feeding and drinking behavior data.
* (Iowa) Development of novel applications of omics data to improve disease resilience in pigs. Infectious pathogens pose a constant threat to the swine industry through increased morbidity and mortality, leading to significant economic challenges and reduced animal welfare. Thus, selecting pigs for disease resilience, i.e. the ability to maintain production performance under disease, has gained traction, but collecting disease resilience phenotypes in disease-free nucleus breeding herds is challenging. The objective of this study was to evaluate phagocytosis assays that can be conducted on blood from young, healthy pigs as potential indicator traits to select for disease resilience in high-health nucleus breeding herds.
* (Iowa) Identification of novel disease resilience traits in pigs. Ensuring low stress levels in pigs is important to maintain good growth and health. With the ultimate objective to develop indicator traits that can be collected on young healthy pigs to select for disease resilience, this project evaluated measurements of the level of stress hormones in hair as potential indicator traits. Stress hormone levels were found to be moderately heritable and a major gene for cortisol levels was identified. Stress hormone levels in hair were genetically correlated with responses to the standard backtest, demonstrating that these hormone levels relate to biologically relevant stress behaviors and coping styles.
* (Iowa) Development of breeding tools for dairy farmers to breed for enhanced profitability and sustainability. Feed for dairy cattle and methane production impact the production efficiency and environmental footprint of dairy farming. This project seeks to develop a breeding tool to allow for selection of reduced methane production and maintain an existing tool to select for improved feed efficiency in dairy cows. Reduced methane production and improve feed efficiency are expected to enhance the sustainability of dairy cattle farming by improving profitability and reducing the impact on impact on the environment.
* (Iowa) Development of new genome tools to advance genetics research and accelerate breeding. Geneticists have identified a number of genes that impact economically important traits in livestock, but little is known about the function of DNA outside of gene which comprises 90%+ of the genome. Genome annotation help geneticists to better understand the function of the livestock genomes. The DNA sequences in non-coding regions outside of genes are believed to contribute significantly to the variation in economically important traits, but non-coding DNA regulatory regions are unannotated in major livestock species today. This project seeks to annotate regulatory regions in the non-genic regions of the genome in cattle, pig and sheep to help determine their roles in traits important to production efficiency, health and sustainability.
* (Iowa) Understanding the role of livestock genetics in disease resistance. Animal agriculture loses at least 20% of its genetic potential because of animal disease. The genetic basis for host resistance to most diseases is not well-characterized and is likely to be highly complex for most diseases. Addressing this knowledge gap requires collaborative work across multiple disciplines. The goal of this project is to identify genes involved in disease resistance to advance research and for breeding animals that are less impacted by disease.
* (Iowa) Application of genetics to improve production resilience of chickens. Local chickens are essential for food security, nutrition, and livelihoods in rural Africa. Local chickens require low resource input and are adapted to local conditions but have low production performance. This study focused on estimating genetic parameters for egg production and egg quality of three Tanzanian local ecotypes, which are essential for development of genetic improvement programs.
* (Hawaii) My research project focuses on genetically improving Hawaiian beef cattle using genomic strategies. Collaborating with faculty from Geography and Engineering, we are exploring interdisciplinary approaches to solve real-world problems. One aspect of this project involves developing a non-invasive sensor to accurately and efficiently detect heat stress in cattle by analyzing molecular changes. This effort requires the integration of diverse data types, including genetics, physiological measurements, phenotypic traits, and climate data.
* (Florida) Hosted visiting PhD student Weronika Klecel for a 6-month stay to develop data analysis pipeline for processing video-derived behavioral phenotypes.
* (Florida) Many informal team-building meetings to establish collaborations between colleagues in engineering, computer science, biomechanics, and sensory physiology to build current funded project.
* (Aquaculture – Multiple Stations) Neil Thompson served as Chair of the National Aquaculture Genomics Workshop hosted at the International Plant and Animal Genome (PAG) 32 in 2025. Presentations: 17 with representation from academic, government and private sector. Attendees: 65 with international and national participation. The Aquaculture Genomics Workshop was proceeded by a social and followed by a business meeting and reception for workshop attendees and speakers.
* (Aquaculture – Multiple Stations) The National Aquaculture Genomics Workshop Group industry partner is The Center for Aquaculture Technologies (CAT, San Diego, CA). Much thanks to CAT, as they provided two student travel awards; two student travel awards were provided by NRSP-8 to a total of four student travel awards to PAG 32 in 2025.
* (Aquaculture – Multiple Stations) The NRSP-8 National Aquaculture Genomics Workshop group elected Linnea Andersen as PAG 33 Workshop Coordinator (2026) and Caitlin Older as the PAG 34 Workshop Coordinator-Elect (2027).
* (Aquaculture – Multiple Stations) The group will expand workshop coordination to non-genomics audiences by establishing an NRSP-8 Aquaculture Genomics session at “The Triennial” Aquaculture 2025 conference (March 6 - 10, New Orleans, Louisiana, USA), which is a joint international meeting of the World Aquaculture Society, the National Shellfisheries Association, and the Fish Culture Section of the American Fisheries Society (AFS). Michael Phelps will serve as the Triennial Workshop Coordinator (2025), and this will increase visibility of NRSP-8 to the general aquaculture audience, industry, and researchers from other disciplines. Benjamin Reading will lead off the session with a presentation overview of NRSP-8 and Aquaculture. In particular this meeting will include the shellfish genome consortia including the East Coast Shellfish Growers’ Association (ECSBC), Eastern Oyster Genome Consortium Workshop, NOAA Advanced Aquaculture Collaborative Programs such as East Coast Hard Clam Selective Breeding Collaborative and others (NECC1901: Integrating Genomics and Breeding for Improved Aquaculture Production of Molluscan Shellfish, https://www.nimss.org/projects/view/mrp/outline/18609) and the AFS Physiological Insights Towards Improving Fish Culture symposium (https://portal.nifa.usda.gov/web/crisprojectpages/0436467-aquaculture-2019physiological-insights-towards-improving-fish-culture-v.html). The triennial is conducted every three years, and a new workshop coordinator will be elected in 2026 to plan for the 2028 triennial.
* (Aquaculture – Multiple Stations) The Visionary Opportunities in Aquaculture Genomics is a Pre-Conference Student Travel Award funded by the USDA to support 10 student travel awards of up to $2000 each and also will include a reception for awardees to attend. This effort is led by Michael Phelps. The Student Travel Award is offered to students and postdocs attending the Visionary Opportunities in Aquaculture Genomics Symposium at the Aquaculture 2025 Triennial meeting. Applicants may be undergraduates, graduate students, or postdocs and applicants are expected to have submitted an abstract for a presentation (oral or poster) through the conference abstract submission portal and deliver the presentation in the format assigned by the conference committee. Recipients are expected to attend the symposium reception to be recognized for this honor. The recipients will have the opportunity to meet professionals engaged in all aspects of aquaculture genomics, attend technical sessions, industry sessions, and workshops specifically designed to address the career development needs of students. This is an excellent time for students to network with potential graduate school advisors or locate entry-level jobs.
* (Aquaculture – Multiple Stations) Our work is to translate aquatic species genomics tools into a usable format for 21st Century biology. Efforts to communicate the outcomes of this work to a broader audience including private sector and traditional biologists who may not be familiar with genetics or may not understand these resources for aquaculture-specific research, are necessary. We updated the following synthesis paper, and the writing team co-chairs who led this effort were Neil Thompson and Linnea Andersen. The manuscript is in review and has been accepted for publication pending minor revision in 2025.
* (Aquaculture – Multiple Stations) Further the writing teams for funding/grants (Steven Roberts, Moh Salem, and Michael Phelps) and other community members contributed to a concept workshop proposal (Advancing Sustainable Aquaculture: Training, Genomics, and Data Integration). Extramural funding will be solicited from NOAA and USDA in 2025-2026 to promote this mission.
* (North Carolina A&T) Attended SAS Viay workshop July 17 2024. SAS Scientists, student’s postdoctoral scientists and PD are engaged in collaborative data analysis. Sheep and goat phenotypic and genotypic data were analyzed to predict the impact environment has on gastrointestinal parasite levels on pasture in St Croix sheep that are parasite resistant and susceptible Boer goat crosses. Machine learning approaches are being investigated. In cows Cytometricic data and EVOS imaging are being used to assess Netosis in blood and milk.

***AIM 3: Education, training, and outreach to develop a data-savvy workforce.***

* (Auburn) Developed a special topic course on basics of HPC use (SLURM system) and RNA-Seq data analysis.
* (Auburn) During spring 2024, I offered a special topics course on Omics Data Sciences Applied to Livestock. 14 students from (11 master’s and 3 PhDs) from Poultry, Fisheries and animal sciences departments were trained on bioinformatics and RNA-Seq data analysis.
* (Cornell) I’m co-chairing the Women in Bioinformatics workshop (WIBI) in 2025 Feb. I delivered a keynote talk at WIBI 2023 and participated as a panelist to discuss career challenges, skill development, gender diversity, and mentorship in bioinformatics. These discussions focused on strategies to increase the participation of underrepresented groups in leadership roles and identified mechanisms to support marginalized communities. Following the event, I shared links to fellowship opportunities and resources to inspire attendees and empower their future endeavors in the field.
* (Kansas State) Development of an KSU Academic Innovation Fund Proposal “Disease Genomics & Diagnostics” of stand-alone educational modules that can be added to existing animal science courses or used as stand-alone training, and linking educational modules with micro-certificates that signal data competencies.
* (University of California-Davis) In collaboration and with funding from the USDA Foreign Agricultural Service (FAS), I conducted a 2-week “5th International Workshop on Regulatory Approaches for Agricultural Applications of Animal Biotechnologies” consisting of 6 plenary meetings (3 hours each; all recorded) and three regional/sector breakout sessions. The entire proceedings was made available at the following website: https://www.isaaa.org/kc/proceedings/animalbiotechnology/2024-5th-intl-workshop. A total of 749 registrants from 90 countries signed up for to attend at least one session.
* (Pennsylvania State) Teaching ANSC 213 – Introduction to Animal Biotechnology. A quarter of this course (~ 4 weeks) covers basic genomics analysis and genome sequencing.
* (Pennsylvania State) Teaching ANSC597 – Transcriptome Analysis in Fall 2024 at Penn State University. The course is designed for biology graduate students with little to no experience using high-performance computing clusters or command line tools. It is a 10-day workshop, with 4 hours of instruction and hands-on activities each day, that takes students from learning the basics of the command line to analyzing large datasets using on campus HPC resources and extracting biological insights from RNAseq training data. By the end of the course, students were able to analyze their own experimental RNAseq data. The skills they gained not only enabled them to work with RNAseq, but also provided a foundation to expand their expertise to other types of functional genomics data, such as ATACseq and ChIPseq.
* (Iowa) Short Courses and Workshops Provided

1. Short course given: Animal Breeding Strategies using Genomics, China Agricultural University, August 12-15, 2024.

2. Workshop co-organized: Platforms and methods for sharing and collaboration on AG2P using public and confidential data. AGBT-Ag, Phoenix, AZ, April 15, 2024.

* (Hawaii) I teach a graduate course, "DNA and Genetic Analysis," which incorporates modern genomics technologies, including third-generation long-read sequencing and bioinformatics analysis. My students greatly benefited from a guest lecture and hands-on training session led by a data science expert from our university. Over the past year, I mentored three graduate students in my research lab: Mandeep Adhikari, who graduated with his Ph.D. in May 2024, and Hasan Pabitra and Urmita Chowdhury, who joined my lab as Master's students in August 2024.
* (Aquaculture – Multiple Stations) A supervised machine learning workflow was published by Benjamin Reading and Linnea Andersen that includes a walkthrough data analysis example that can be used in university level courses and training. The manuscript was published using methods developed for teaching the course AEC 510 Machine Learning Approaches in Biological Sciences that is part of the North Carolina State University Data Science Academy (https://datascienceacademy.ncsu.edu/); AEC 510 is included in the course track for the Agriculture Data Science Certificate Program with the College of Agriculture and Life Sciences (https://cals.ncsu.edu/psi/ag-data-science-certificate/). This is an interdisciplinary graduate certificate program that applies the power of data science to issues and opportunities in agriculture, food, and the life sciences by bringing together faculty and coursework from across 15 departments within the College of Agriculture and Life Sciences, as well as the Colleges of Engineering, Sciences, and Natural Resources. This model can also serve as a blueprint for similar initiatives with the NRSP-8 and partner institutions. Over 100 students have been trained in this AEC 510 approach.
* (North Carolina A&T) Received a USDA 1890 postdoctoral scholarship to engage in collaborative research with Dr. Ben Rosen in USDA ARS and the Bovine Pan genome consortium. This project includes opportunism to learn pan genome workflows and design training modules to increase genomics capacity

Across stations, many students have completed training under the leadership of NRSP-8 members in the past year including more than two dozen undergraduate students, six MS students, 10 PhD students, and one postdoctoral fellow.

Key accomplishments by the NRSP-8 leadership team on behalf of the entire community in the past year include creation of an External Advisory Board, outreach activities by NRSP-8 members at several non-genetics meetings, awarding travel awards to 10 trainees to attend the annual meeting, completion of the first stakeholder survey (aimed at educators), update of the NRSP-8 website (animalgenome.org) and initial planning for a Summer 2025 workshop. These are detailed under “Milestones and Activities” below.

**Milestones and Activities:**

*1. Creation of an External Advisory Board.* A key component of NRSP8’s proposed activities is the engagement of stakeholders representing diverse facets of animal agriculture. Stakeholders will be engaged in multiple aspects of this project, including key decision-making processes. An External Advisory Board (EAB) of industry stakeholders will help ensure that project activities are focused on industry needs. The EAB will meet with NRSP8 leadership at least annually. Nine individuals representing extension, commodity industry groups, and the technology sector have been recruited to the EAB. The EAB is currently comprised of the following individuals:

* Chad Page, Utah State University, Small ruminant extension specialist
* Jose Carrillo, Council for Dairy Breeding, Dairy industry
* Johnny Mac Smith, Grayson Jockey Club Research Foundation, Inc., Equine industry
* Travis Williams, Hy-Line International, Poultry industry
* John Buchanan, Center for Aquaculture Technologies/AquaBounty, Aquaculture industry
* Randie Culbertson, Iowa State University, Beef extension specialist
* JR Tait, Neogen Genetics, Bioinformatics industry
* Austin Putz, Hypor Genetics, Swine industry
* Kelli Retallick, Angus Genetics, Beef industry

A virtual meeting was held 11/1/24, and a subset of EAB members were available to attend the in-person annual meeting in January 2025. The NRSP-8 workshop being planned for Summer 2025 is designed to address many of the discussion points/suggestions that were brought forward by the EAB members at the November meeting.

*2. Development of stakeholder surveys.* There are many potential stakeholders that have an interest in the activities of the NRSP8 community. The first two stakeholder groups targeted are educators and extension specialists. The educator-focused survey was released in late spring 2024 and results were collected through the summer and early fall. Preliminary results were presented at the January 2025 annual meeting:

* 152 completed responses, representing a range of institution types (land grant, historically black college or university, community college, independent research institute, others)
* More than two-thirds of the respondents were active faculty members (across levels) who routinely teach undergraduates. Animal science departments were overrepresented among respondents (not surprisingly, given the distribution list).
* Desired teaching support identified by respondents included: guest lectures from domain experts, support to develop lecture content, support to develop experimental topic, training in genetics/genomics/bioinformatics to increase comfort level teaching these topics, micro-certifications (badging), and multi-institutional online courses.

NRSP-8 community members are well-qualified to address some of the needs revealed in this stakeholder survey, but they will all require additional funds that the project does not have. We need to identify partners to leverage efforts and funding support and will need to develop teams to systematically tackle each need. Once the analysis of results of this survey is complete, a report will be generated and shared with the community.

A stakeholder survey focused on extension specialists has been designed and will be released in early 2025. Results will be reported at the next annual meeting.

*3. Support for students and early career investigators to engage with genomics research.* Travel support to meetings is a key component for engaging students and early career investigators. Ten awards were given to trainees (trained by current NRSP-8 members) to attend the 2025 annual meeting at PAG. Registration for the event was sponsored by Scherago International, while travel funds were provided by NRSP-8. All trainees were required to present a lightning talk at the annual business meeting workshop, and also had to present either a poster or a podium talk in another session. Winners were selected based on evaluation of the quality of the submitted abstract and alignment with NRSP-8 aims. Species of interest was not considered in the scoring criteria, but fortuitously, research from all major animal commodities groups were represented. The 10 awardees were from 9 different institutions and represent a range of training levels:

* Leland Ackerson IV, PhD Student, Michigan State University
* Johanna Aldersey, Postdoctoral Fellow, Oak Ridge Institute for Science and Education (ORISE)
* Yifei Fang, PhD Student, Cornell University
* Samantha Hammack, DVM/PhD Student, University of Illinois
* Fazhir Kayondo, PhD Student, Iowa State University
* Guangsheng Li, PhD Student, Cornell University
* Hunter McConnell, PhD Student, University of Missouri
* Temitayo A. Olagunji, Postdoctoral Fellow, University of Idaho
* Guglielmo Raymo, PhD Student, University of Maryland
* Junjian Wang, PhD Student, North Carolina State University

*4. Development of workshops and other training opportunities.* Initial outreach activities have been undertaken by the NRSP-8 leadership team with presentations and booths at various conferences not typically focused on genetics (American Society of Animal Scientists, American Association of Equine Practitioners). In addition to this, and to species-focused activities that will occur at PAG in 2026 in parallel to the NRSP-8 annual meeting, a workshop is planned for June 6-7, 2025 in Lincoln, NE immediately following the conclusion of the USPLF (precision livestock farming) conference. The target audience is scientists, educators, and extension agents who are interested in harnessing genetics/genomics tools to further their research, teaching, and extension goals. Day 1 will feature workshop tracks aimed at different levels of genetics experience (introductory, intermediate, and advanced), a feature specifically requested by the EAB. Industry speakers will highlight how animal genomics tools are being used in modern industry across species, and there will be ample opportunity provided for networking. Day 2 will focus on Research Interest Groups (RIGs) that will be tailored to the interests of attendees. EAB members will be invited to participate in this event.

**Outputs:** A key deliverable for NRSP-8 is accessibility of the tools and resources developed by the community. The animalgenome.org website and AnGenMap listserv have been important tools historically leveraged by the NRSP-8 community. Over the past year, in collaboration with the Animal Genomics RCN, this website has begun a major overhaul to make it an attractive and user-friendly portal for both geneticists and the general public. The AnGenMap listserv is still being used to aid in communication of initiatives, and a NRSP-8 bulletin board has been established to provide a central location for both academic and industry members to post workshop announcements, training opportunities, internships, etc.

**Impacts:** Currently, a major focus is retention of previous members and recruitment of new members to the multistate group, with particular interest in involving extension officers and industry stakeholders. There are currently 92 NRSP-8 members (with several joining in the past year) representing institutions in 35 states. The stakeholder surveys will be used to guide future actions by the NRSP-8 community to maximize impacts on the broader agricultural industry. The activities outlined under the Aim-specific accomplishments above reflect immense impact by the NRSP-8 community as a whole. Of particular note are the many interactions with industry stakeholders undertaken by NRSP-8 stations across a variety of commodity groups (listed under Aim 1).

**Indicators:** The “new” NRSP-8 application was accompanied by letters of support from more than 20 industry stakeholder groups, indicating broad buy-in for the efforts of the community to extend genomics capacity to a broader range of Animal Science stakeholders. This is underscored by the many stakeholder interactions reported by our NRSP-8 members. Industry leaders approached about EAB membership were also enthusiastic about participation and are contributing materially to the direction of planned efforts. Continued indicators of success will include membership in NRSP-8, completion of stakeholder surveys (in addition to informal stakeholder feedback), and attendance at NRSP-8 sponsored meetings and workshops.

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**Grants and Contracts Awarded**

These are self-reported by members of the NRSP-8 community, who leverage community resources in their individual and collaborative work.

USDA-NIFA conference workshop, “Genomics and Epigenomics of Aging” Workshop at PAG32, 11/2024-11/2025, $18,500

Role: PI, Co-PI: Riddle N.C., Biga, P.R.

Seed grant (6/15/2023-6/15/2024): Genomic Innovation Hub Seed grant Award, Cornell, $15,000

Title: Establishment of CUT&Tag Protocols in Early Embryos to Study Role of Maternal Factor MOF In Bovine ZGA

Role: PI, coPI: Soon Hon Cheong

USDA HATCH grant (10/1/2022-10/1/2025), $90,000

Title: 2022-23-106: Identification of novel regulators of milk protein synthesis in dairy cattle experiencing heat stress.

Role: PI, co-PIs: Joseph McFadden, Gerlinde Van De Walle

Miller, L.C. (PI). Integrated training in the pathobiology and genomics of livestock diseases. USDA-NIFA-HEP- 009754. National Needs Fellowship $241,000.

Miller, L.C. (PI). Equipment Proposals to Support Biomanufacturing Training and Education. Kansas State University NSF ENGINES Biomanufacturing Training & Education. 2024. Total award: $312,500 to purchase a CosMx™ Spatial Molecular Imager (SMI) - the first to be used in animal health -omics.

Further Evaluate Herbonis Feed Additives for protection against lameness and improving the well-being of broilers in a lameness challenge model. Nuproxa Switzerland; 1/2023-12/31/2024; $72,729; PI-Alrubaye. coPI- Rhoads

ABI Gap 2024: Funding to Purchase Two Shared-Use, Replacement Quantitative PCR Machines. Arkansas Biosciences Institute; 4/2024-5/2024; $34,457; PI: Rhoads; CoPI: Zhuang, Westerman, Durant, Lessner, Du, Durdik, Lewis, Pinto, Alrubaye

ABI Funding to Purchase Two Shared-Use, Replacement Quantitative PCR Machines. Arkansas Biosciences Institute; 7/2024-5/2025; $34,265; PI: Rhoads; CoPI: Zhuang, Westerman, Durant, Lessner, Du, Durdik, Lewis, Pinto, Alrubaye

National Institute of Farm Bill" Partnership: Proactive Pig Production (p3): Animal-centric AI for Indoor Environmental Control to Optimize Productivity, Welfare, and Sustainability"

NC A&T PI Mulumebet Worku. NCSU sub award

1890 Faculty Research Sabbatical Program (FRSP) Research experiential training to expand collaborative research in genomics 2024 M Worku and Benjamin Rosen Animal Genomics and Improvement Laboratory, BARC-ARS Beltsville MD

“UC Davis Intentional Genomic Alteration Animal and Veterinary Innovation Center (AVIC)”

FDA 1U18FD008480-01. E.A. Maga Van Eenennaam (PD), $5,000,000 9/15/2024-8/31/2029

“Virtual and in-Person Workshops on Regulatory Aspects of Genome Editing in Animal Biotechnology Development” USDA Cooperative Agreement FX23TA-10960C036, A. L. Van Eenennaam (PD), 10/1/2023-9/30/2025, $162,730 (Year 1) + $255,000 (Year 2)

Award: Functionally Annotated Equine Pan Genome with Infrastructure for an Accessible, Integrative, Community Genomics Resource

Principal Investigator: Kalbfleisch, T. (Durward-Akhurst, co-PD)

Status: Funded

Sponsoring Organization: UNIVERSITY OF KENTUCKY

Sponsoring Organization Reference ID: 3200006215-25-072

Award: Identification of putative exercise-induced pulmonary hemorrhage causing variants in Ontario's Thoroughbred racehorses

Principal Investigator: Durward-Akhurst, Sian

Status: Closed

Sponsoring Organization: UNIVERSITY OF GUELPH

Award Dates: March 1, 2024 - June 30, 2024

Award: A multi-omics approach to prediction of exercise associated sudden death in Thoroughbred racehorses

Project Investigators: Durward-Akhurst, Sian A. (Principal, 1%)

Status: Funded

Sponsoring Organization: Horseracing Integrity and Safety Authority

Date Proposal Submitted: March 2024

Award: A robust pipeline to functionally annotate non-traditional model pangenomes

Project Investigators: Durward-Akhurst, Sian A. (Co-Principal), McCue, Molly E. (Co-Principal)

Status: Funded

Sponsoring Organization: University of Minnesota Informatics Institute Medium Seed Grant

Date Proposal Submitted: 2022

Award Dates: 2024 – Present

Award: The horse as a naturally occurring model of arrhythmias and autopsy negative sudden arrhythmic death

Project Investigators: Durward-Akhurst, Sian A. (Principal, 75% Funded: 75%), Dudley, S (Primary Mentor, 1%), Talkachova, A (Mentor, 1%), Rendahl, A (Mentor, 1%)

Status: Funded

Sponsoring Organization: NIH K12

Institution: NCATS

Date Proposal Submitted: September 2023 (Funded in February 2024)

Liu: USDA-NIFA A1201 project: Transcriptome Dynamics And Gene Regulatory Networks During Testis Development And Spermatogenesis In Cattle. $650,000.

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| **PIs** | **Project Name** | **Funding level** | **Funder** | **Years** |
| Greiner, Schulz, **Dekkers**, Steibel | Assessing the value of animal weights | $150,000 | Merck Animal Health | 2023-2024 |
| Cheng, de los Campos, Steibel, **Dekkers** | Platforms and methods for sharing and collaboration on AG2P using public and confidential data | $1,090,629 | USDA-NIFA-AG2PI | 2024-2026 |
| Schnable, Roy, Dutta, **Dekkers**, Salas-Fernandez, Singh, Yu | Scalable Bayesian feature selection with application to plant and animal breeding | $1,099,964 | USDA-NIFA-AG2PI | 2024-2026 |
| Reecy, Li, **Koltes** | QTLdb and CorrDB: Resources to Help Close the Genotype to Phenotype Gap | $650,000 | USDA-NIFA-AFRI | 2021-2024 |
| Peñagaricano, Mantovani, White, Weigel, Santos, Jeong, **Koltes,** Appuhamy, VandeHaar, Tempelman, Baldwin, VanRaden,  French, Kalscheur | Integrating genomic, nutritional, and microbial strategies to mitigate enteric methane emissions from dairy cattle | $3,300,000 | FFAR-GCI and CDCB | 2023-2026 |
| **SUMMARY:** | **5 projects: $6,290,593** |  |  |  |

PI: Yanghua He; co-PIs: Tyler Ray, Yao Zheng, Mark Thorne, Birendra Mishra, Jinzeng Yang, CN Lee, Kyle Caires. "UH CTAHR CARES Pilot Research Project: Wearable Multi-modal Heat-Stress Detecting Sensor for Cattle," (2024-2025, $70,006, awarded), September 24, 2024, Hatch funds

PI: Yanghua He. Uncovering Genetic Markers of Thermal Tolerance in Pacific white shrimp. USDA NIFA CTSA Grant. $100,000. USDA Award Number: 2020-38500-32559. 08/01/2024-07/31/2025. Co-PIs: Dustin Moss (Oceanic Institute of Hawai'i Pacific University) and Mi-Jeong Lee (UH Manoa).

Co-PI: Yanghua He. An integrated transcriptomic and epigenetic atlas of chicken embryonic stem cells. PI: Jiuzhou Song (University of Maryland). USDA NIFA AFRI Competitive Grant. PROJ NO:MD-ANSC-08253. Sponsor Award ID: 130487-Z5383201. $650,000. 07/01/2023-06/30/2027.

“Insulin dysregulation: placental changes and foal health.” Grayson-Jockey Club Research Foundation, Inc. April 2024-April 2026. PI: Elaine Norton. $115,003.

NIH # R01AR0853341: Psychometric Reliability and Validity for Behavioral Metrics of Osteoarthritic Pain in Horses (GALLOP).

~$331,000.

Multistate # S1094: Genomic tools to improve the health, welfare and performance of the horse.

$1000.

Hatch Project # 7001788: Genomic tools to improve the health, welfare and performance of the horse. $1500.

USDA NIFA, Southern Regional Aquaculture Center, 2024-2026. First Steps Towards Genetic Improvement of Red Drum Stocks. Lead Scientist: T. Sink. Cooperators: Hollenbeck, C., Portnoy, D., Reading, B.J., and Chesser, B. Status: In progress. $300,000.

National Institute of Farm Bill" Partnership: Proactive Pig Production (p3): Animal-centric AI for Indoor Environmental Control to Optimize Productivity, Welfare, and Sustainability"

NC A&T PI Mulumebet Worku. NCSU sub award

1890 Faculty Research Sabbatical Program (FRSP) Research experiential training to expand collaborative research in genomics 2024 M Worku and Benjamin Rosen Animal Genomics and Improvement Laboratory, BARC-ARS Beltsville MD