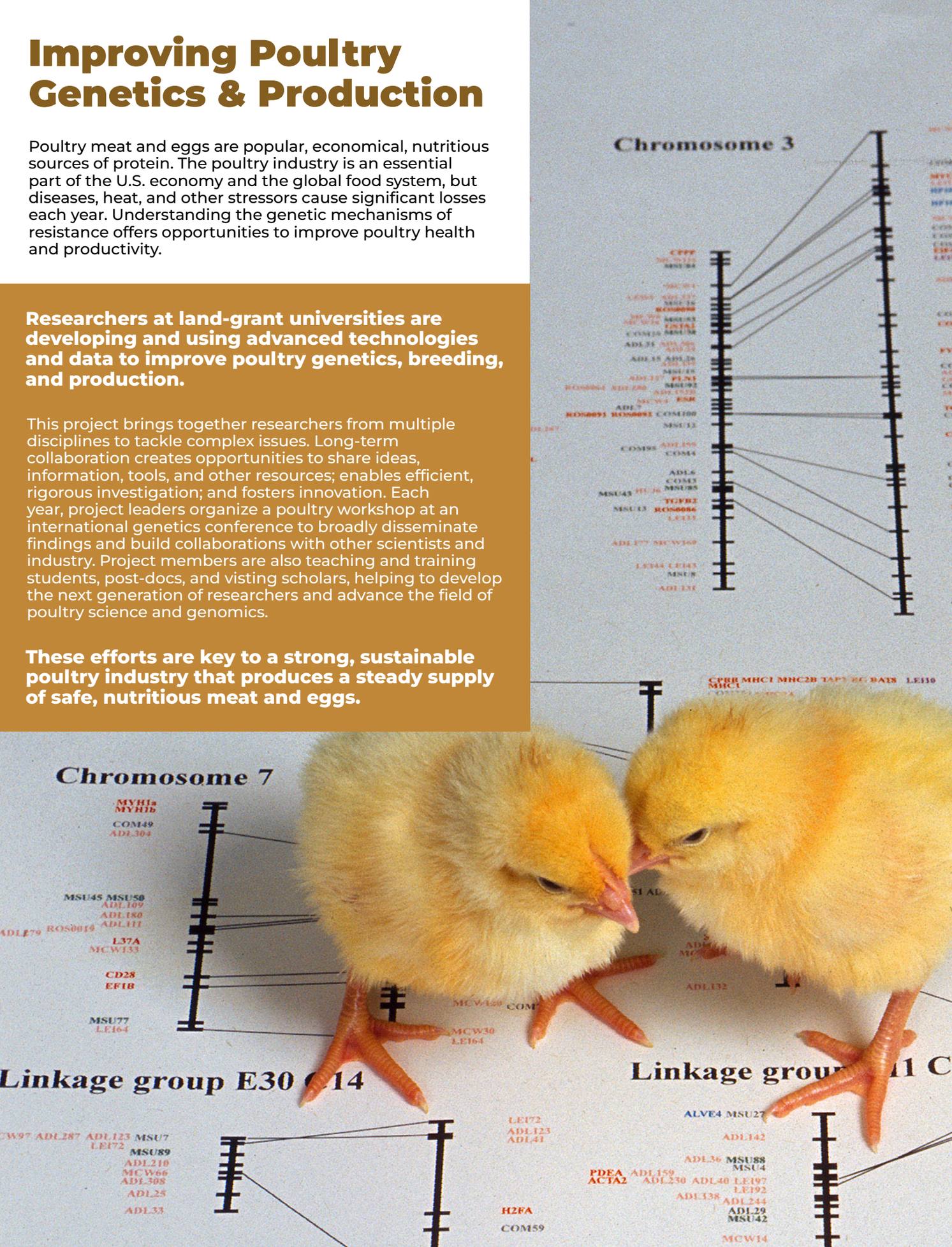
Improving Poultry Genetics & Production

Poultry meat and eggs are popular, economical, nutritious sources of protein. The poultry industry is an essential part of the U.S. economy and the global food system, but diseases, heat, and other stressors cause significant losses each year. Understanding the genetic mechanisms of resistance offers opportunities to improve poultry health and productivity.

Researchers at land-grant universities are developing and using advanced technologies and data to improve poultry genetics, breeding, and production.

This project brings together researchers from multiple disciplines to tackle complex issues. Long-term collaboration creates opportunities to share ideas, information, tools, and other resources; enables efficient, rigorous investigation; and fosters innovation. Each year, project leaders organize a poultry workshop at an international genetics conference to broadly disseminate findings and build collaborations with other scientists and industry. Project members are also teaching and training students, post-docs, and visting scholars, helping to develop the next generation of researchers and advance the field of poultry science and genomics.

These efforts are key to a strong, sustainable poultry industry that produces a steady supply of safe, nutritious meat and eggs.



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Multistate Research Fund IMPACTS

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Project Highlights 2017-2023*

Research shed light on genetic mechanisms that influence disease resistance. Findings will help guide strategies to improve poultry health and productivity, reducing losses for producers and providing safer, higher quality poultry products for consumers. For example, researchers:

Identified genetic markers to improve poultry resistance to **aflatoxin B1**, a potent carcinogen that causes annual losses estimated at over $500 million. *University of Minnesota*

Generated new knowledge about **"woody breast"** (which causes poor texture in chicken and turkey breast meat), including associated genetic variations and molecular perturbations that influence its onset and progression. *Texas AgriLife Research*; *University of Delaware*

Identified genes associated with **Newcastle virus** disease response in indigenous African chickens. *University of California, Iowa State University, University of Delaware*

Identified genes associated with **"water belly" (ascites)**, a major cause of sickness and death among broiler chickens. *University of Arkansas*

Made new discoveries about the role of genes and mutations that influence the development of **tumors** during **Marek's disease**. *USDA-ARS-Avian Disease & Oncology Laboratory*

Showed that chemical inhibition of a certain enzyme could be used to limit **inflammation** in chickens suffering from **Salmonella**. *University of Florida*

Showed **Campylobacteriosis**, the leading cause of human foodborne **diarrhea**, can be controlled in poultry and humans by breeding poultry with enhanced resistance. *Royal Veterinary College*

Mapped resistance to lameness caused by **bacterial chondronecrosis with osteomyelitis (BCO)**, which is a significant animal welfare issue among commercial broiler chickens. *University of Arkansas*

Identified a new brain structure involved in regulating **stress** response in broilers and developed a non-invasive molecular marker to monitor stress in poultry. *University of Arkansas*

Characterized and annotated **immune cells and receptors** in the chicken genome that contribute to disease resistance. *University of Arizona. University of Missouri, Western University of Health Sciences*

Showed for the first time that variations in the MHC-Y gene region contribute differentially to the strength of **immune responses** in chickens. *Beckman Research Institute at the City of Hope*

Shed light on the underlying genetic and epigenetic factors that modulate **vaccine** efficacy. *University of California; USDA-ARS-Avian Disease & Oncology Laboratory*

Suggested an effective approach for generating enough genomic and phenotypic information for breeding programs that enhance the disease resistance of very small populations of chickens like those in sub-Saharan Africa, which are raised under scavenging conditions that make it difficult to control diseases through vaccinations and biosecurity measures. *Royal Veterinary College*

Scientists studied the genetic mechanisms of heat and cold stress, which threaten the quality of poultry meat. For example, researchers:

Collaborated to quantify **climate change** impacts on poultry breast muscle growth and development. *Michigan State University, University of Minnesota, and Ohio State University*

Identified the molecular mechanisms altered by **temperature extremes**. *Michigan State University*

Identified genes associated with resistance to **heat stress**. *University of California, Iowa State University*

Provided new insights on **heat stress** and cellular antioxidant activities. *University of Georgia*

To foster research and advances in poultry breeding and production, project members developed new resources, methods, tools, and data, including:

Genetic material, including chicks, fertile eggs, blood, tissues, DNA, and RNA. *Iowa State University*

New **typing methods** that are easier, quicker, and more reliable. *Beckman Research Institute at the City of Hope*

An approach that allows efficient profiling of multiple genes in large sets of samples. *University of Tennessee*

New **statistical** and **machine learning** algorithms for prediction of feed efficiency and leg disorder traits in broiler. *University of Wisconsin-Madison*

The **Host-Pathogen Interaction Database**, which details protein-protein interactions between chickens and pathogens and is visited by researchers worldwide. *Mississippi State University*

Standardized naming for 300 poultry genes, which helps researchers more easily understand and translate their results. *University of Arizona, Beckman Research Institute at the City of Hope*

Several discoveries will influence poultry feeding strategies. For example, researchers:

Identified ways to manipulate hen diet to modulate **fat accumulation** in offspring. *University of Tennessee*

Showed that delayed access to feed can negatively affect goblet cells, leading to increased risk of **pathogen infection**. *Virginia Tech*

Showed that the hours of **light** exposure per day in early life affects the **microbiome** of chickens. *Texas AgriLife Research*

Beyond Poultry

Advances in tools and methods for genetically modifying poultry could have significant benefits far beyond the poultry industry. Birds are crucial parts of ecosystems, are a source of recreation, and can offer many biological insights, but many bird populations face increasing challenges such as disease, climate change, and habitat loss.

* This project was renewed in 2023. See the latest project information: bit.ly/NC-1170