Improving Poultry Genetics

NC-1170 (2008-2013)

Demand for High Quality Poultry on the Rise

Meat and eggs are efficient, economical, and nutritious sources of protein around the world. In the U.S., recent scientific discoveries in genetic selection, disease control, and nutrition have propelled unprecedented growth of the poultry industry. Americans eat more poultry than either beef or pork, and consumption is on the rise. The U.S. is a major producer and exporter of poultry meat. In recent years, the combined value of production of chickens, eggs, and turkeys has neared $36 billion dollars per year. To sustain the poultry industry and meet domestic and international demands for poultry health and poultry product quality, scientists must continue to improve knowledge and test new technology that will boost production efficiency and poultry performance.

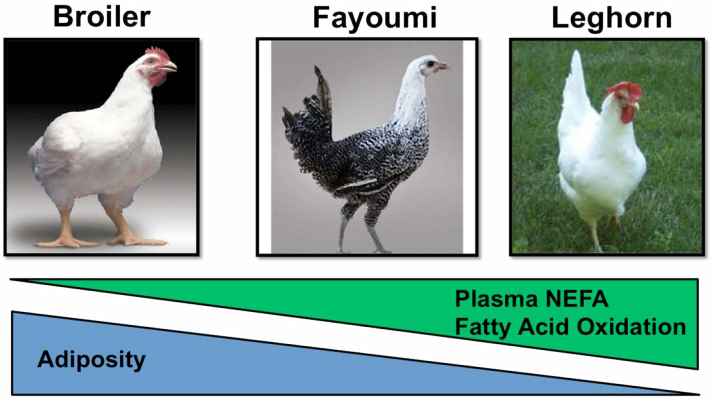
Lance Cheung/USDA Flickr photo.

Multistate Research Project Brings Better Poultry to the Table

Multistate Research Project NC-1170 has brought together researchers and forged strong partnerships with the poultry industry and producers. NC-1170 coordination allows researchers to share information, resources, and tools, including databases, cell lines, and experimental poultry populations, and address complex national and local issues facing the poultry industry. NC-1170 has also produced and shared chicks, fertile eggs, blood, tissues, DNA or RNA from a variety of poultry lines (including highly inbred and advanced intercross lines), expanding genomic studies among cooperating researchers.

United Soybean Board Flickr photo.

Over the past five years, NC-1170 researchers have developed new state-of-the-art tools, statistical models, and methods that have enabled scientists to much more rapidly and accurately evaluate poultry genes as well as regulatory regions in order to explore the fundamental biological mechanisms responsible for poultry growth, physiology, behavior, and health. Analyzing genes has made it possible for NC-1170 researchers to generate genetic and physical trait maps that show how genes are organized for chicken and turkey and to draft the sequence of the whole chicken and turkey genomes. Researchers have also developed a standardized vocabulary and categorization scheme for genes to help researchers compare genes. With full genome sequences, poultry can be used as a versatile model for understanding genes and genetic mechanisms important to skeletal, limb, and organ development in other birds and vertebrates, including humans.



Studying three genetically distinct lines of chickens enable NC-1170 researchers to identify genes and metabolic pathways involved in fatness and leanness.

Increased understanding of gene function and expression has helped researchers identify genes that influence important traits that control growth, reproduction, and disease resistance. By giving researchers a better understanding of how genetic variation leads to physical variation in chickens and turkeys, this work is improving poultry breeding and production. Identifying

genes related to Marek's disease and other diseases (like avian influenza, coccidiosis, cellulitis, avian metapneumovirus, and infectious laryngotracheitis) has helped develop strategies that reduce the incidence and severity of the disease. Other researchers have identified traits related to aggression, stress, aflatoxicosis, and nutrient intake during embryo development and as adults. These discoveries have led to more effective treatments for poultry diseases and more efficient feeding, which in turn have improved animal welfare and performance. Breeding and raising chickens with improved genetics makes production more efficient and less costly, which lowers prices for consumers and helps the U.S. poultry industry maintain its competitive edge. These advances ensure a sustainable supply of safe, nutritious protein.

With improved genetic resistance, along with good handling and hygiene, chickens are less susceptible to diseases. FAOALC Flickr photo.

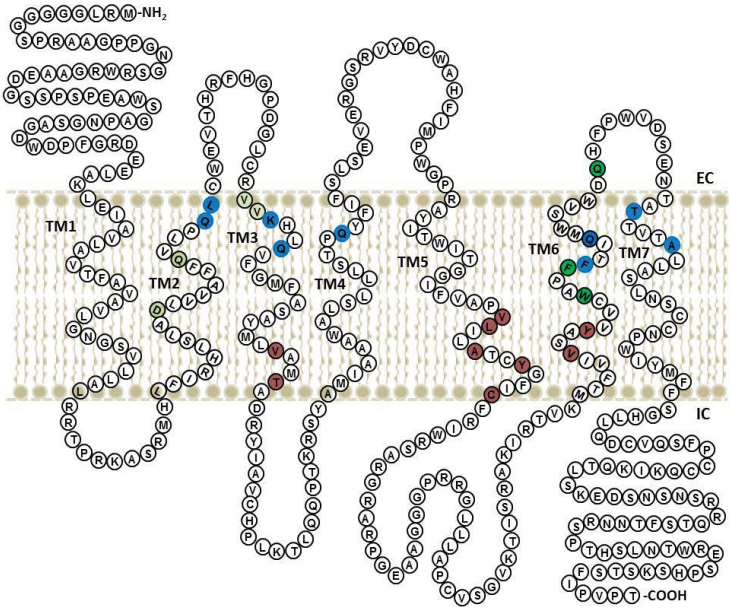
Want to know more?

This project was supported, in part, through USDA's National Institute of Food and Agriculture by the Multistate Research Fund established in 1998 by the Agricultural Research, Extension, and Education Reform Act (an amendment to the Hatch Act of 1888) to encourage and enhance multistate, multidisciplinary research on critical issues that have a national or regional priority. For more information, visit *http://ncra.info/*.

Administrative Advisor: Susan J. Lamont (sjlamont@iastate.edu)

Participating Institutions & Researchers:
Beckman Research Institute at the City of Hope (M. Miller)
Cornell University (P. Johnson)
Iowa State University (S. Lamont, J. Dekkers)
Michigan State University (J. Dodgson)
Mississippi State University (M. Edelmann, C. McDaniel, B Nanduri)
North Carolina State University (C. Ashwell, J. Petitte)
Oregon State University (D. Froman)
Purdue University (W. Muir)
University of Arizona (F. McCarthy, S. Burgess)
University of Arkansas (W. Kuenzel, B. Kong, D. Rhoads)
University of California, Davis (M. Delany, H. Zhou)
University of Delaware (B. Abasht)
University of Georgia (S. Aggrey)
University of Maryland (T. Porter, J. Song)
University of Minnesota (K. Reed,)
University of Tennessee (B. Voy)
Virginia Tech (E. Wong)
University of Wisconsin (G. Rosa)
USDA-ARS-Avian Disease and Oncology Lab (H. Cheng, H. Zhang)

This Impact Summary was compiled and designed by Sara Delheimer.



NC-1170 researchers have identified molecules that regulate how birds respond to stress. Diagrams like the 2-D illustration above help researchers keep track of the various amino acids involved. This figure comes from the following paper by NC-1170 members: Jayanthi, S., S.W. Kang, D. Bingham, B.A. Tessaro, T.K.S. Kumar and W.J. Kuenzel. 2014. Identification of antagonists to the vasotocin receptor subtype 4 (VT4R) involved in stress by molecular modeling and verification using anterior pituitary cells. *J. Biomolecular Structure and Dynamics* 32:648-660.