Biodiversity is a reservoir of genetic variation. Populations subject to little intensive selection for production traits, or to high levels of natural selection, are likely to retain more variation for adaptive traits. Such variation is important to conserve for unpredictable future needs. Likewise, as genomic tools become ever more powerful, diverse populations are likely to provide important allelic variants for production traits. Among North American poultry, conservation of biodiversity is most readily accomplished at the population or breed level, including commercial populations, research lines, standard breeds, landraces, and heritage breeds. Such populations are maintained by numerous institutions, in situ and through cryopreservation. Nevertheless, there has been a contraction in research populations held by public institutions, numerous heritage breeds remain at risk, and even commercial populations have contracted due to changing economies and corporate consolidation. Cost remains a major hurdle for in situ support, and emerging cryopreservation techniques for poultry must be further developed to mitigate this cost. New models to better maintain diverse populations are needed, otherwise many unique lines, and genes, will be lost. One new opportunity for maintaining diversity is emerging through the growth of niche markets for pastured poultry products. Fulfillment of this market using standard or heritage breeds alongside new broiler hybrids adds an important means for preserving genetic diversity while meeting consumer demand.

**Key Words:** genetics, breed, biodiversity, conservation, market


Conservation of genetic diversity in agriculturally important species is required for sustainable agriculture. Climate change, newly emergent disease, increased pressure on land and water resources, and shifting market demands require that animal genetic resources are conserved and used sustainably. In commercial layer and broiler chickens, genetic variation is often maintained passively within and among limited numbers of breeds, strains, and lines. Modulated by continued selection for desirable production-level traits, there is compelling evidence indicating that commercial lines have reduced genetic variation compared with their ancestral progenitors, Red Junglefowl. Extant Junglefowl species, including heritage breeds of poultry, contain reservoirs of untapped genetic variation. Heritage breeds have experienced reduced levels of artificial selection but still have traits allowing them to adapt to differing local environments, agricultural practices, and cultural conditions, which may be quite different from those encountered in modern agriculture. Building knowledge of these existing genetic resources requires proper genetic inventories of available genetic assets. A PlexSeq (Agriplex Genomics) SNP panel consisting of 101 loci, with at least one locus present on 26 of the 38 (68%) chicken autosomes, generated genotypes that were used to determine the magnitude of genetic diversity and population structure in: (1) heritage Finnish Landrace chickens; (2) heritage broilers from Canada and the United States, and (3) standard breeds of chickens within Canada. Particularly evident in the Finnish Landrace, analysis of molecular variance (AMOVA) revealed substantial SNP variation at the among-population level and reduced variation among individuals within a population. STRUCTURE-based analyses indicated significant population-level stratification among the Finnish Landrace chickens and most heritage broilers and standard breeds from Canadian and US sources. Historical relationships were identifiable and even source populations of synthetic lines could be identified based on admixture proportions. Once thought applicable only to rare and endangered species, themes of conservation biology and population genetics combined with next-generation genetic technologies are now providing unprecedented opportunities to define and ultimately conserve genetic variation in wild, heritage, and commercial poultry. The potential to augment commercial poultry genetic management is substantial and both wild junglefowl and heritage breeds should be considered an invaluable genetic reservoir to protect and used to help maintain a healthy poultry industry.

**Key Words:** conservation, genetic diversity, population structure, SNP, heritage breed

**609S MHC-B variation in global chicken populations.** J. Fulton*, Hy-Line International, Dallas Center, IA.

The major histocompatibility complex (MHC) of the chicken consists of 2 clusters of highly polymorphic immune response genes, MHC-B and MHC-Y, both of which are located on chromosome 16 but which segregate independently. The chicken MHC-B was initially identified as the B blood group locus. Multiple studies have shown a strong association between variation within the MHC-B region and resistance to numerous disease pathogens. MHC-B variation can be identified utilizing a panel of single nucleotide polymorphisms (SNP) that encompass 230,000bp of the MHC-B region. The specific combination of SNP alleles across this region defines a haplotype. The MHC-B haplotypes were studied within a diverse set of populations including traditional breeds in Germany, the Finnish Landrace breed, heritage breeds within the US and Canada, and rare breeds within the US. A high amount of MHC-B variation was found among these populations. MHC-B haplotypes from common breeds could be identified in some of the populations, suggesting historical introgression from these breeds. On average, 50% of the haplotypes within a breed were novel, with 85% of these being breed specific. The rare or endangered breeds within the US appeared to have suffered an MHC bottleneck as the traditional breeds sampled in Germany had an average of 5.1 vs 3.3 haplotypes found in the US sampled breeds. These traditional or rare breeds are a source of untested novel MHC variation. With the deceasing availability of therapeutics for disease treatments in poultry, novel MHC variation should be examined in the context of better understanding of disease resistance.

**Key Words:** MHC, diversity, chicken, heritage breed

**610S Poultry models informing human health science.** C. Ashwell*, North Carolina State University, Raleigh, NC.

Poultry species have fed humans for many centuries. With domestication and selective breeding poultry will continue to be a major protein source for a growing global population. Beyond their agricultural significance, poultry species have made numerous contributions to human health. Likely the first vertebrate to be studied developmentally due to the innovation of artificial incubation, the chicken embryo was the basis...
of all developmental biology before the genomic era. Notable scientists including Pasteur, Rous, and Varmus have utilized the chicken and its viruses to advance the understanding of biology. Landmark discoveries in immunology, nutrition, virology, endocrinology, oncogenesis, angiogenesis, and genetics have been and will continue to be conducted in poultry species. These scientific milestones and new pioneering research will be discussed in light of significant advances in technologies including stem cells and genome editing.

Key Words: poultry, human health

611S Animal resources—Inventory, unique features and challenges. N. Anthony* and S. Orlowski, University of Arkansas, Fayetteville, AR.

Selection programs in university settings are dying across the US and Canada. There are many factors that contribute to this loss with the most obvious being financial and infrastructure costs. In addition, university, departmental and personal challenges are faced every day by researchers maintaining experimental lines. Although efforts have been made to indefinitely preserve genetic material they continue to be unreliable for long-term storage. Resource populations maintain genetic variation that would have otherwise been lost. The development of random bred control populations have allowed for a snapshot of the poultry industry in 20 year increments starting with the Athens Canadian Random bred in 1955 and ending with the development of the most recent random bred control in 2015. These lines have been instrumental in evaluating the maturation of the poultry industry. Random bred populations have served as base populations and respective controls for selection studies designed to explore direct and correlated responses as well as dissect metabolic challenges that crop up as a result of traditional selection practices. Other resource populations have focused traits that have been identified, preserved and concentrated through selection. Many of these populations serve as research models to study human disease conditions. The expectation is that these research lines would dovetail with the basic and applied programs of colleagues and collaborators. Although granting agencies typically do not support the development of research lines, the inclusion of research lines in a grant proposal clearly elevates the overall proposal success. The purpose of this presentation is to provide an overview of the research lines developed over the past 30 years as well as a discussion of the challenges faced by those maintaining experimental populations.

Key Words: broiler, genetic preservation, research lines, random bred control

612S Grassroots support for genetic preservation programs. M. Zuidhof*1 and V. Carney2, 1University of Alberta, Edmonton, AB, Canada, 2Alberta Agriculture and Forestry, Edmonton, AB, Canada.

Genetic preservation programs all over the world have been dealt a serious blow by economic realities. Most government and university reservoirs of historically relevant and scientifically valuable lines have been terminated due to budget cuts over the last 3 decades. The Poultry Research Centre (PRC) at the University of Alberta has managed to maintain 11 lines of historical and scientific importance by engaging grassroots support. Since 2014, the PRC has engaged the public in an effort to recover the cost of maintaining these valuable lines by developing 3 innovative programs. Members of the community were first invited to adopt a hen, then to eat heritage meat, and most recently in partnership with a regional agricultural supplies retailer, to consider growing heritage chicks for themselves. This initiative required considerable effort to mitigate risks, build and manage relationships, and reach out to a new demographic with the will to help save our unique genetic resources. As a result of this effort, however, the genetic preservation program is now financially self-sustaining. As an additional benefit, our Heritage Chicken Program provides unique and expanded opportunities for teaching, extension, research, and connecting with consumers.

Key Words: genetic conservation, community engagement, funding, performance benchmark