

## POULTRY GENETICS AND BREEDING

Genetica y mejora avicolas

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Dramatic changes have occurred in poultry genetics and breeding since the conclusion of World War II. The dual purpose chicken is no longer vogue, having been replaced in meat production by the hybrid broiler and in commercial egg production by the hybrid layer. Concomitant to the genetic development of specialized chickens for meat and egg production has been the emergence of large commercial breeding organizations whose main focus is the production of superior germ plasm.

It is of more than academic interest to realize that the permanent changes in poultry meat and egg stocks have resulted from a combination of the application of genetic theory and the organizational structure of breeding establishments. The latter enhanced the rate of genetic change by allowing for large population sizes, intensive selection pressure, and the evaluation of many crosses in different environments. All of the genetic changes which have occurred, however, have not been desirable. There is a conundrum which involves different needs during the life cycle of the chicken and the mating designs needed to produce the final hybrid meat or the egg producer used in commercial production. Stated a different way, the desirable characteristics of the chicken used in the production of meat and eggs for human consumption may be quite different from that needed in the parental populations. Broiler production requires a fast-growing lean chicken that is an efficient converter of feedstuffs. Yet, the large parents of such a product are undesirable because of their low reproduction and their inefficiency in the utilization of feedstuffs.

Underlying many breeding decisions is the tradeoff between making phenotypic changes via genetic and/or non-genetic means. Complicating such decisions are genotype-environment interactions, short-term versus long-term gains, and correlated responses. The papers presented in this plenary session address these problems in an assortment of ways. Each shows that poultry breeding is multidisciplinary and although each addresses a specific topical area, there is overlapping via the genetic-nongenetic matrix which is involved.

My sense in developing this session was to have the papers focus on topical areas with each speaker interfacing his research with that of others. Poultry breeding has had a long history of investigations involving genetic resistance to infectious agents and stressors. Laboratory studies when brought into the world of applied breeding require that there be a concern with correlated responses of production traits, the loss of selection pressure on other traits, and the possibility of the effort going for naught due to solutions brought about by nongenetic means such as the development of immunization programs.

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Although overall mortality may be low under current husbandry practices, subclinical infections can mask true selection pressure. Then, there are the aspects of selection for resistance to specific infectious agents, selection for general disease resistance, and the role of heterosis. These subjects are reviewed by Dr. Hartmann in his paper, "Selection and genetic factors on resistance to disease in chickens".

The breeding of meat chickens has created a dilemma of obtaining fast-growing efficient food converters without having large inefficient parents. Selection for juvenile body weight has resulted in changes in growth and traits associated with reproduction. In too many cases the nuclear and parent flocks are inefficient and the broilers per se have become too fat because they are compulsive eaters. Research is needed on the effects of growth, feed intake and water intake on carcass composition, the onset of sexual maturity, and reproductive capabilities. Such information should be obtained under various nutritional and feeding regimes which, in turn, implies an interfacing of genetics with other disciplines. The orchestration of such endeavors, while generally wanting in the past, are today reaching a greater level of sophistication as seen in the paper "Feed and water consumption of chickens" by Dr. Marks and the paper "Growth and the onset of sexual maturity in chickens" by Dr. Soller.

The past quarter of a century has seen a dramatic reduction in the number of poultry breeding organizations. An overwhelming majority of commercial chickens are the fruit of only a score of breeding groups whose products are available throughout most of the world. Thus, not only is there concern with how genotype-environment interactions may influence selection in crossing programs per se, but there is the multitude of factors relating to the performance of various commercial stocks under different husbandry systems and in diverse geographical areas. These subjects are addressed by Dr. Horn in his paper, "Genotype-environment interactions in chickens".

Lastly, there is a role of qualitative genetics in poultry breeding. Commercial application of alleles at specific loci have moved in and out of vogue. Alleles for blood groups, skin color, feather growth, and feather color have had both minor and major impacts on poultry breeding. Currently, there is considerable interest in specific alleles for disease resistance and for dwarfing as vehicles to improve the efficiency of poultry production. Dr. Hartmann in his presentation alludes to aspects related to disease resistance while Dr. Merat addresses the general topic in his paper, "Qualitative aspects of poultry breeding".

Hopefully, the collection of papers in this section will show where we have been, where we are now, and where we are going in poultry genetics and breeding as applied to the production of meat and egg type chickens.