

## POULTRY GENETICS

### History of Poultry: Chicken

The ancestor of the domestic chicken, red jungle fowl (*Gallus gallus*), can still be found today in regions of South East Asia, including India, Burma, Malaysia, Thailand, and Cambodia. The first of these birds is believed to have been domesticated over 8000 years ago. These jungle fowl are much smaller than most of today's domestic varieties, and are a tropical species adapted to live in much warmer conditions than most current poultry. They are typically found in areas with thick vegetation befitting of their name.



The jungle fowl were initially domesticated for either religious or entertainment purposes, and are still used in sacrificial religious ceremonies or for cockfighting. The Romans were the first society to develop and use the chicken as an agricultural animal. Romans even developed specialized breeds including laying hens that could lay an egg a day; a rate similar to today's commercial lines. The Romans expanded from just creating breeds of chicken to creating an entire poultry industry which utilized concepts such as force feeding, hybrid vigor, and caponizing. However, with the fall of the Roman Empire, the industry collapsed as well and chickens became little more than farmyard scavengers. Those original breeds created by the Romans were lost and the practice of keeping poultry for agricultural purposes fell out of favor and did not resume until the 19<sup>th</sup> century.

In the 19<sup>th</sup> century poultry breeding came back into prominence in the European region. As early as the year 1810, six breeds of poultry are known to have existed in England (the Game, the White or English, the Black or Poland, the Darkling, the Large or Strakeberg and the Malay). Over a fifty-year period in England, formal poultry shows were developed and many new breeds were created leading to the formation of numerous Breed Societies. The modern breeds we have today are mainly derived from two types of birds: the Asiatic and the Mediterranean. Other breeds were developed by crossing breeds, and the geographic origin of a breed is often indicated in their name (i.e. Rhode Island Red).



During the last two centuries more than 300 breeds of chickens have been developed; however, very few of these breeds have survived commercialization and many breeds have been lost forever. The last 40 years have seen the rise of the commercial hybrid rather than new breeds of chickens. These hybrids are of two main kinds; meat-type and egg-type. Both types of hybrids have been selected to maximize the amount of production and minimize the amount of food needed for that production. Today less than two dozen private companies worldwide create hybrids based on specific production characteristics (body weight, growth rate, livability, pullet

quality, age at sexual maturity, egg weight, egg production, eggshell quality, interior egg quality, and ability to convert feed to eggs or meat).

Egg-laying types can be divided into light and medium hybrids. The light hybrids are derived from the White Leghorn. These birds lay white eggs and the mature female weighs around 3.3 lbs. The medium hybrids are derived from the Rhode Island Red and lay brown eggs with a mature female weighing around 4.4 lbs. Both types of hybrids have been highly selected to produce more and larger eggs while decreasing their body size and feed intake. These two types of hybrids not only differ in their size, feather and egg color but also their temperament. White hybrids are often better suited to be raised in cages, while brown hybrids do well in cage-free systems.



The meat hybrids have been developed from breeds such as the Cornish and White Plymouth Rock. These hybrids have been selected for growth rate, meat yield, and proportion of white meat as well as high feed conversion. Today the majority of the meat lines are derived from the Cornish on the male side. The Cornish gives the modern broiler chicken its broad breast, short legs, and plump carcass. The majority of meat lines are also white feathered. White feathers are preferable as they are easier to pick than dark feathers, and do not leave dark spots on the carcass. To ensure that offspring are white feathered, male lines are bred to be dominant for white plumage. Even when these males are crossed with a colored-feather female, the majority of their offspring will have white, or nearly white, feathers. Another trait that has been selected in the modern meat bird is yellow or white skin. This trait has been selected for solely because of consumer preference.

### **History of Poultry: Turkey**

The wild turkey originated in North America, as documented by fossil records dating back over 10 million years. When Europeans arrived in North America, two species of wild turkeys were present. Turkeys have two misleading names. First, their scientific name *Meleagris gallapavo* was incorrectly given them by Linnaeus who thought that the turkey was related to the guinea fowl. Secondly, the name *turkey* itself is often misunderstood as well. The turkey was domesticated in Mexico over 2000 years ago by the Aztecs. When the Spanish explorers brought turkeys back to Europe, they were called “turkeys” as most exotic birds entering Europe at that time (16<sup>th</sup> century) were entering through the country of Turkey.



The domestic bird was then taken back into what is now Virginia by European colonists. Interestingly turkeys were originally domesticated for their plumage not their meat. While the Aztecs did use turkeys as a source of protein (meat and eggs), they were desired for their feathers which were used for decoration. It was not until the 20<sup>th</sup> century that turkeys started to be selected for meat production. By the late 1930s, mature males were weighing around 40 lbs.

with females weighing about half that. Commercial turkeys are bred specifically to have more meat in the breast and thighs. White feathered turkeys are generally preferred, since they do not have unsightly pigment spots on the skin when plucked.

As turkeys were selected for increased size, an undesirable side effect occurred. This unanticipated side effect was that the birds lost their ability to breed naturally. Artificial insemination of breeder hens is now necessary; this is the only way commercial turkeys are able to reproduce. Turkey semen can be chemically 'extended' and used up to 24 hours after collection.

### **Concepts and Methods of Poultry Genetic Selection:**

*Single Line:* Breeder uses a closed flock, continuously selecting the better birds each generation and breeding from them.

*Hybrid Vigor:* Outbreeding which results in increased quality of the hybrid offspring.

*Male Line and Female Line:* Crossing of a Male line only line with a Female online line. The opposite sex of each line is destroyed at day 1 of age.

*Strain Cross:* Crossing of two or more different strains rather than selecting for traits within one strain. Only a few desired traits are selected within each strain rather than all the desired traits in one strain.

*Two-line Cross:* Allows for offspring to have positive traits from both lines, however, at a lower rate than the original lines.

*Three-line Cross:* First a two-line cross is done then the offspring of that cross are crossed with a third line to obtain more positive traits.

*Four-line Cross:* Two separate two line crosses are completed than the offspring of these two crosses are bred to obtain offspring with traits from all four lines.

*Strains used for crossing must nick:* This means that the two lines that are being crossed must complement each other.

*Inbred Crosses:* Crossing of related individuals to improve uniformity. This often reduces performance. Performance can be restored by crossing lines.

*Sex-linked Meat Lines:* Certain feather colors and speed of feather growth can be linked to the sex of the bird. The trait will only appear in one of the sexes, making separation of chicks at hatch easier.

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**Structure and Flow of Genetics in the Poultry Industry:**

