

The Oldenburg Horse, Winter 2004, Riding the Crest: Oldenburg Verband Breeding the World's Best Horses for Sport

Riding the Crest: German Oldenburg Verband Breeding the World's Best Horses for Sport

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For the past 25 years I have been a geneticist. I have been trained, performed research and educated hundreds in a field that has grown by leaps and bounds in the past half a century. However, there is no guarantee that I could breed a top sport horse. Genetics is a game of probability and breeding is a game of chance. It is the responsibility of the breeding organization and ultimately the individual breeder to apply basic genetic understanding to reduce the risks of breeding by scientifically choosing the best horses to breed for sport. Here I will discuss some basic genetic principles and how they have been applied to the breeding of the sport horse as evident in the successful breeding program of the German Oldenburg Verband..

A foal will possess 50% of its mother's genes and 50% of its father's genes. Genetically, the contribution from each parent is equal. However, many breeders would disagree. Many breeders feel that the dam imparts greater than half of the foal's make up. In fact, to a certain extent, that is true. The mare's egg, which will be fertilized by the stallion's sperm contains nourishment, developmental information and mitochondria (structures within cells that generate chemical energy for cellular activities). The mitochondrial DNA is always maternally inherited since the mitochondria passed to the developing foal comes from the mother's egg. In that sense, the mare does contribute more than 50% of the genetic contribution to the foal. In addition, the foal develops for 11 months in the maternal environment of the uterus and spends 4-6 months, from foaling until weaning, learning from its birth mother. Certainly, this time will influence the foal, behaviorally, but not genetically.

Understanding genetic inheritance is difficult and complicated. Also, it is difficult to separate genetic inheritance from environmental influence. The fact is that horses are born with a genetic potential, which comes directly from the inheritance of genes from their parents. The environment, feeding and training will shape the genetic

potential. To understand genetic inheritance it is best to start with the most basic situation. The best example is single gene inheritance that shows clear dominance versus recessive alternatives that can be clearly identified by observation. In the realm of horses, the gene that produces gray coat color can be examined. Gray is produced by the inheritance of a single dominant gene (G) which will produce a gray coat. A complication of this gene, is that the phenotype (what the horse looks like) is not usually observed at birth. The foals are born black, bay or chestnut and turn gray overtime. Gray horses can only be born to parents where at least one parent is gray. However, it is possible for a non-gray horse to be born to two gray parents. If both parents are heterozygous for the gray gene (Gg) then, 25% of their offspring or 1 out of 4 foals will have a probability of being non-gray. The genotypes of a mating between heterozygous gray horses (Gg xGg) will result in a probability of producing 75% gray foals and 25% non-gray foals. A homozygous gray parent (GG) will always produce gray offspring because it can only pass a G, gray gene which is dominant, to its offspring. While two non-gray parents (gg homozygous recessive) can never produce gray offspring.

Unfortunately, most traits that sport horse breeders are interested in procuring in their offspring, are the result of multiple genes and multiple gene interactions that complicate the science of selecting mates significantly. We can look at our own human families to see how genetic variation and recombination can differ so drastically among siblings even from the same parents. So, how should the breeder go about selecting mares and stallions to breed?

The breeder must be mindful of the fact that genes inherited from parents do not go away, nor are they diluted. In each sex cell, a sperm or an egg will contain half of the genetic makeup of the stallion or mare. Randomly, half of these genes will be from the mother and half from the father. If a horse is homozygous for a given gene, for example GG for the gray phenotype, the only gene that can be passed to the offspring is G, so all of the offspring will be gray. Breeders are looking for the same effect for traits that result from multiple genes. Even in this age of astounding advances in molecular genetics we still must rely on the examination of offspring in order to attempt to predict what traits a stallion or a mare is dominant for and how successful they are at passing the traits onto their offspring. The ability to consistently pass predictable traits to offspring is referred

to as prepotency. Rubinstein I is well known to be prepotent for several desirable characteristics including; modern type, conformation, rideability, trainability, gaits and outstanding temperament. To attest to Rubinstein's prepotency, at the 2003 World Equestrian Games three Rubinstein I sons were competing in dressage, no other sire had more than one. In addition, two of the sons placed in the top 10! Rubinstein's son Renoir-UNICEF received the highest score for gaits, 8.8 in the Grand Prix Special, being awarded several 10s from judges for his walk. Rubinstein's son Relevant received several of the highest scores for his work at the piaffe and his two tempi flying changes. It is for this reason that breeders must choose bloodlines well known to be prepotent for desired characteristics especially to breed to individuals or bloodlines that might produce in an unpredictable or unknown manner. It is also important to remember that although a particular individual might possess outstanding bloodlines, it is vital that the individual also expresses the desired characteristics in their phenotype. It is the genes that are expressed in the phenotype that are typically dominant (but not always) and will most frequently be passed to offspring. It is the responsibility of the breeding organization and the breeder to determine which individuals are suitable for breeding; not only must they possess good bloodlines, but they also must express excellent traits.

Of course there is always the temptation to breed closely related lines in order to compound the most outstanding characteristics. However, there is the risk of compounding deleterious traits, as well, that might affect the vigor and hardiness of the individual. What horse breeders have found to be the answer to this dilemma is to cross unrelated outstanding bloodlines. For example the Oldenburg Verband has been highly successful with crossing Donnerhall or Donnerhall sons on Rubinstein I daughters. In 2002, 5 year old Don Davidoff (Don Gregory/Rubinstein I) won the Dressage Horse Championship and the 5 year old World Breeding Championships. Don Davidoff is linebred 5S x 4d (5S=the fifth generation sire in the sireline x 4d=the fourth generation dam in the damline) approximately 10% to Manolete (Don Davidoff has approximately 10% of his genes in common with Manolete).

Inbreeding, when ancestors are repeated 4 generations or less in the pedigree, is the best way to "fix" desired characteristics. However, it is very risky since it can result in inbreeding depression (a loss of vigor, hardiness and fertility). Many problems

associated with purebred breeds of dogs are the result of inbreeding depression. Many dog breeds are well known for defects such as hip dysplasia (especially in larger breeds such as the German Shepherd) and cancer of the liver and spleen in Golden Retrievers.

These disorders are often due to recessive genes that become compounded in closely bred animals. In trying to maintain and perpetuate the breed-defined traits (which is of utmost importance in the breeding of dogs), it becomes necessary to breed closely related animals. However, it is important not to perpetuate the recessive alleles (different forms of a gene) that are responsible for producing disorders. This can only be done by not breeding animals that show undesirable traits. Unfortunately, some traits such as cancer, do not become evident until the dog is well into its reproductive years and might have already produced several offspring. In these situations, it might be necessary to rely on molecular genetic diagnosis of defective genes that produce traits that do not become apparent until later in life.

Horses are extremely expensive to breed and the outcomes of a breeding are not usually completely evident until the offspring are 3-10 years old. For these reasons, the horse breeder should always take a more conservative route. An example of this is apparent in 2002, the Oldenburg Springpferde Zuechter Verband held its premier licensing and gave the pinnacle award to Lovis Corinth (Landor S/Corofino/Lantaan). This 1999 Oldenburg stallion had "nothing left to desire" in any respect and represents the ultimate jumping machine. Lovis Corinth is not inbred, but he has very high infusions of jumping blood from several different jumping lines. In his pedigree are the world's best producing jumping sires including Landgraf I, Gotthard, Furioso II, and Cor de la Bryere. The linebreeding of Lovis Corinth is 18.44% Lord (5d x 4D x 5d), 16.62% Ladykiller xx (4S x 5s x 6D), 12.51% Farnese (4S x 5D x 6d) and 9.90% Cor de la Bryere (4D x 5D) (All Breed Pedigree Database). Having this strength of jumping ability in his genes ensures that he will also be a progenitor of jumping horses. This will be an interesting breeding stallion to watch.

The Thoroughbred breeding program offers many excellent examples since strict Thoroughbred breeding records have been available for many years and the success of a breeding program is quickly evaluated by a horse's success on the race track. There are significantly fewer variables in identifying a successful racehorse versus a successful

sport horse. Early talent in sport horses can be estimated via stallion licensings (Korung) and performance tests, mare performance tests and three-year old to six-year old championship classes. However, the ultimate evaluation for most dressage horses and many jumpers is success in the Grand Prix show ring that often does not come to fruition until the horse is nearly 8 years old or older and highly dependent on proper training and development.

Most warmbloods are 10% or less linebred. Whereas, Thoroughbreds are generally about 10-20% linebred. Studies of Thoroughbred stakes winners show that inbreeding (repeating an ancestor within 4 generations or closer) is not as successful in producing stakes winners as linebreeding (repeating an ancestor 5 generations or more). Theoretically, linebreeding within the fourth to sixth generations avoids the genetically rooted weaknesses of inbreeding but can still effectively replenish and bolster the genetic pool with the desired genes. As a rule of thumb, a horse's genetic impact on its offspring is essentially reduced by 50% with each successive generation. To compensate for the 50% effective reduction, horses prepotent or possessing a high degree of homozygous dominant genes for desirable traits must be selected and used to pass on their desirable characteristics in a highly predictable manner.

Secretariat was an unusual Thoroughbred being less than 10% linebred (~7.91% linebred to St. Simon). Due to this, Secretariat was considered a cross-bred or hybrid of sorts. Many breedings that produce crossbreds or hybrids produce an outstanding performance individual but can have unknown potential in the breeding shed. This was very much the case with Secretariat. His first generation offspring were a disappointment being less than stellar individuals on the race track, but now Secretariat's second generation offspring and subsequent generations are successful and Secretariat can be recognized in the damline of many successful broodmares.

The success of a Thoroughbred breeding program is measured by success on the racetrack. Predictions about a given breeding can be estimated by determining the dosage index based on an aptitudinal analysis. Thoroughbred race track performance is assigned as Brilliant for early speed in short races between 5-7 furlongs to Professional for endurance in longer races. Based on dosage calculation from sire data, the success of a horse on the racetrack can be estimated. Thoroughbreds are bred based on their ability

to pass on speed and stamina. Sport horses are much more difficult to evaluate. To complicate matters even more, the dressage sport, can be subject to changes in emphasis in judging or the impact of the number of scores given to specific movements in the dressage test. The jumping sport is affected by the demands of the course. Some courses require that the horse be more powerful off the ground while others can test the horses speed and agility over the jumps. For these reasons, it takes a great deal of foresight and vision on the part of a breeding organization to determine the direction a breeding program should follow.

In the early 70s and 80s the Oldenburg Verband recognized the need for a lighter, more sensitive riding horse. Recognizing this need, the organization began to infuse substantial amounts of Thoroughbred blood into their breeding stock by using select Thoroughbred stallions that would transmit the necessary refinements without having a deleterious effect on the good characteristics that the breed possessed. For a period of nearly 20 years, many of the winners of the stallion licensings in Oldenburg were sired by Thoroughbreds. The Selle Francais stallion, Furioso II known as a foundation sire of the modern Oldenburg was sired by Furioso xx, a French-bred Thoroughbred.

By virtue of the guidelines set forth by most European warmblood breed organizations, horses from bloodlines other than Oldenburg can be evaluated and approved for breeding. By allowing outside genetics to influence the breed, the breed organizations have a vast resource of genetics to draw upon. Limited and closed stud books such as the Trakehner and Thoroughbred breeds limit their resources by having to remain within their own gene pool. The Oldenburg Verband frequently relies on Trakehner, Anglo-Arab and Thoroughbred gene pools for improvements and upgrading. Some of these horses must pass the licensing evaluation as well as the rigors of the performance test in order to earn their right to stand at stud. For example, a track record for racehorses is often utilized as their performance record, as long as the handicap weight that they carried on the racetrack was significant enough. Some stallions must be performance tested to gain approval. Once approved, the stallion's progeny are scrutinized for the next 3-4 years. If the stallion transmits to his offspring quality conformation, rideability, character, temperament, good movement and athleticism then he will have met the criteria to remain an upgrader for the sport horse breeding

organization. In this way, the breeding organizations that permit utilization of outside blood for breeding are primarily based on the vision of the breeding directors. Breeding organizations have a palette of all of the best blood in the world available in order to develop and sculpt their breed. Selecting the best and integration becomes the art and science of the breeding program and ultimately, the breeder.

It is difficult to know, early on, which stallions will become foundation sires and make the greatest impact on a breeding program. It takes many offspring and sometimes many years to clarify the success of a breeding program. It is evident that the sport and the breeding of horses for sport are entwined together in continual evolution.

Breeding is dynamic. It is not stagnant and it is ever changing and sometimes elusive. Obviously, as great stallions and mares age and die, their genetic legacy is only available through their sons and daughters. With the advent of genetic and reproductive modern technology applications to horse breeding through frozen semen, embryo transplantation and even whole organismal cloning, offer many new opportunities for breeding. However, due to the interdependent evolution of breeding and sport, it is unlikely that great stallions of the past would have the same importance on the current breeding scene. If we had a clone or frozen semen of a great stallion such as Furioso II, would we choose to breed to him? Maybe not. Furioso II might have been a great stallion for breeding and improving the stock of his time, but on the bloodlines available today (which he had a great impact in producing), he may no longer be the breeder's choice.

Breeding is evolution. It is dependent on the selective pressure of continual improvement in riding and training techniques and the ever more challenging standards of the sport. Breeding is an evolution and the breeding program and strategies that were developed in the initial modernization of the Oldenburg breed continue today. The organization must have a vision of the ideal and the future needs of the sport. Through inspections, licensings, performance tests, young horse classes and the ultimate evaluation; the Grand Prix arena, the breed organization must continue to evaluate and redirect the breeding program and strategies of its individual breeders to achieve the visions and the ultimate goals of the breed. The success of any breeding program and any breeder must be based on the understanding and critical evaluation of basic genetics,

topped off with a vision for the future and the development of the ultimate performance and breeding horse.

Resource: All Breed Pedigree Database, www.pedigreequery.com/allbreed/