Genetics Basics

The Building Blocks of Every Breeding Program

Our goal as breeders is to assemble the right combination of desirable dominant and recessive genes (traits) in each litter so that puppies produced are genetically better than the generation before

- All dogs have 39 pairs of **chromosomes**, with approximately 19,000 **genes** strung out along their length. These genes carry hereditary information **(DNA)** that determine specific characteristics for each individual dog.

- **Each dog has two copies of every gene**, one of which it randomly inherits from its sire and one it randomly inherits from its dam. These two genes may be the same or they may be slightly different. These differences contribute to each dog's unique physical features and account for the differences between each dog and each breed.

- When a dog has two copies of the same gene, they are said to be **homozygous**. When the two genes they have are different, they are known as **heterozygous**.

- The combination of genes that a dog has is known as the **genotype**. The physical characteristics a dog has is known as its **phenotype**. The genotype (the dog's genes) influences the phenotype (the way it looks.)

- Genes are either recessive or dominant. A **recessive gene** is only expressed if the genes it receives from both parents are the same. A **dominant gene** is always expressed, even if it is paired with a different gene. Many traits are **polygenic**, meaning they are controlled by more than one pair of genes.
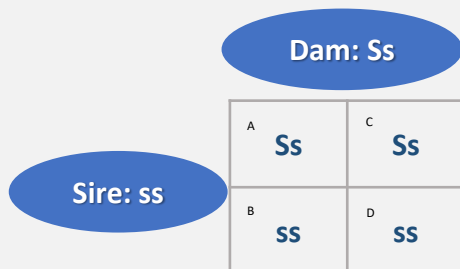
Genetics Basics, continued

Example Recessive Traits

- Short ears
- Large skull size
- Light eye
- Bulging eye
- Overshot or undershot bite
- Good shoulder angulation
- Good stifle angulation

Example Dominant Traits

- Low set ears
- Dark eye
- Black nose
- Forechest
- Straight topline
- Good rib spring
- Poor shoulder angulation
- Poor stifle angulation

Example: The sire has the recessive genes for good shoulders and expresses them in his phenotype. The dam inherited the genes for good shoulders and poor shoulders. She expresses poor shoulders because good shoulders are a recessive trait.

Dam: Ss

A Ss	C Ss
B ss	D ss

Sire: ss

- (A,C) Each puppy from this mating has a 50% chance of inheriting the dominant poor shoulder genes from its dam and will have poor shoulders.
- (B,D) Each puppy has a 50% chance of inheriting the good shoulder genes from the sire and dam and will have good shoulders. Since the good shoulder genes are recessive, these puppies are homozygous for this trait and can only pass on the good shoulder genes to their offspring.

Dachshund Coat Traits

- The **Wire** coat is dominant over all other coats. Both parents must carry a Smooth or Long gene to produce anything other than a Wire coat.

- The **Smooth** coat is dominant over the Long coat. Both parents must carry the Long gene to produce a Long coat.

- The **Long** coat is recessive to both the Wire and Smooth coat.

Genetics Basics, continued

Inbreed, Linebreed or Outcross?

- **Inbreeding** (breeding of parents and siblings) increases the number of homozygous genes (good and bad) in the litter.

- **Linebreeding** (breeding of other relatives) should have a common ancestor behind both parents within 3 or 4 generations.

- **Outcrossing** works best when the sire and dam are each inbred or linebred (although not to each other.)

Tips for Selection

- Sires and dams should be in good overall condition and health (physically and genetically) and be free of serious faults.
- Avoid breeding dogs who have shy or aggressive temperaments or produce it.
- Consider what the stud dog has already produced in previous litters.
- Breeding to a relative of a desired stud dog isn't 'just as good' as breeding to the desired dog.
- Don't double up on the bitch's faults when choosing a stud dog.
- If the best puppy in the litter is not as good as the parents, it's not worth adding to the breeding program.
- When evaluating a litter, bring in the expert eye of a mentor or other experienced breeder.

Resources

- AKC Canine College – ABC's of Breeding Courses: Orlandi

- Born to Win, Breed to Succeed: Craige-Trotter, 2008

- Genetics of the Dog: Willis, 1989

- Practical Genetics for Dog Breeders: Willis, 1992