# Prioritizing Health Concerns

A good breeding program can take decades to create. Breeding a Pug that is correct to the standard will undoubtedly require years of mentorship from established breeders that have come before us. Breeding is somewhat an art, correcting one area only to sometimes lose in another. In addition, the mating of parents, whelping bitches and raising of puppies can take many more years to have more than an elementary understanding.

Along with conformation and temperament, breeding a healthy pug that is free from pain and suffering should also factor into any breeding decision. Health testing is a tool that can help us achieve that. There are two types of testing for inheritable disorders: phenotype testing (based on a dog's actual anatomy/physiology) and genotype testing (analysis of the DNA that can detect a recessive gene even in a "carrier" whose phenotype is normal). There are no guarantees that dogs screened by phenotype testing will not carry the recessive genes and pass them on to the puppies. Also if the issue is widespread, eliminating all affected dogs could have a devastating effect on the genetic diversity of the breed. Furthermore, some problems that show up later in life, sometimes after several generations have been produced, giving the breeder a false belief that his dog is not affected

## Pug Health Screening Priority Chart

| Health Issue | Impact on Welfare | Prevelance | Tests Available |
|---|---|---|---|
| *BOAS | High | High | Functional grading test available through OFA. Cambridge scheme. |
| *Eyes (PK) | High | High | Veterinarian eye exam. [1] |
| *Pug Myelopathy | High | Med | Cause and mode of inheritence is unknown.Research is ongoing. |
| *PDE | High | Med | DNA test available. [2] |
| Eyes (Other) | Med | Low | OFA screening available. |
| Heart | Med | Low | OFA screening available. |
| Hips | Low | High | OFA screening available. |
| Knees | Low | Low | Veterinarian screening available. |
| DM | Med | Low | DNA Test. [3] |
| Elbows | Low | Low | OFA screening available. |
| PK Def | Low | Low | DNA test Available. |

1 *Cause and mode of inheritence is unknown. While an eye exam will show PK, over 80% of pugs have PK. It is not possible to reduce PK without a known cause, a viable test and a population wide effort. Much research is needed*

2 *It is not recommended to remove our NS Pugs.We could accidently eliminate beneficial genes.*

3 *Test not recommended due to extremely low prevelance in pugs. DM and PM are not the same issue.*

The chart above can give preservation breeders an understanding of the health screenings available to them and how they would apply to our breed. The first four items marked with a * are high priority health concerns in pugs. They have both a high impact on welfare and a high/med prevelance in the breed. These are the items breeders should be working to reduce by whatever means we have available. Pugs that have good conformation, no PK and are great breathers should be preserved by all breeders. While we have only one genetic test and one functional test amongst the priority items, we have ongoing research with the hopes to fully understand the genetic processes and develop reliable tests for the future.

A brief summary of the priorty items are below:

Brachycephalic Airway Syndrome (BOAS) is a disease of the upper airway in some (not all) Brachycephalic dogs. BOAS has also also been linked to changes in the lungs, as well as in the gastrointestinal tract. Dr. Jane Ladlow's team at Cambridge (UK) has developed a Respiratory Functional Grading Scheme to assess the presence of BOAS in Pugs. The RFG Scheme has been licensed by the OFA due in part to the hard work of our health committee. The current recommendation is to remove the #3 grade dogs (3-4%) from a breeding program. The #2 grade dogs have some signs of BOAS and should breed only to non-affected dogs. The theory is that over time the population will move in the direction of less affected dogs with a higher population of great breathers. Aside from its value to breeders it is an excellent assessment of the respiratory health for any Pug, possibly minimising needless surgeries. Hopefully the research continues and we can discover the genes involved in BOAS.

Pigmentary Keratitis/Keratopathy is the corneal pigmentation in the eye of Pugs. PDCA sponsored research published in 2013 by Dr. Labelle concluded “This condition may have a genetic basis, and further studies are warranted to determine etiology”. Research by Gunderson 2013 says of Pugs, ”the greatest single factor is probably genetics because other breeds with similar conformation have far less pigment (e.g., the Bulldog, Pekingese, Shih Tzu, etc.).” In contrast the 2019 study in the UK claims it is caused by medial entropion of the lower eyelid (MELE). Dr Labelle and others conclude that PK affects 80+% of pugs. Since it is so widespread it may be extremely difficult or improbable to breed out this condition without a genetic test. Our club is working to fund further research to confirm its cause and develop a useful genetic test.

Pug Myelopathy (aka Rear Limb Ataxia) causes paralysis is the rear legs of pugs. Currently there is no screening test for PM. Be aware that Pug Myelopathy is not DM. The PDCA has been instrumental in funding ongoing research to find the cause and develop a DNA test.

Pug Dog Encephalitis (aka Necrotizing Meningoencephalitis or NME) is an inflammatory disease of the brain that can cause a variety of signs and symptoms, most commonly seizures. The PDCA was instrumental in funding the research that led to the creation of a genetic test. The test is done at UC Davis and will identify if a pug has a low risk (NN or NS) or a higher risk (SS) of developing PDE. The test is used as a tool to avoid producing higher risk (SS) puppies. NS, SS or unknown dogs should only be bred to a NN dog so we do not double up on the recessive S gene (one gene is given from each parent). It is not recommended to eliminate the recessive S gene because it will diminish breed diversity.