1. **Has Embark identified genetic markers or tests for Autoimmune diseases and if so, which ones?**

   Embark has not identified a specific genetic marker for autoimmune diseases in any breed at this time (such as autoimmune thyroiditis in the Alaskan Klee Kai). These conditions are complex and are likely influenced by multiple genes and environmental factors, so no single test can predict risk at this time. Embark does test for certain autoimmune conditions with known genetic causes (SPAID in Shar Peis as one example), and the full list of health conditions we screen for is available on our website, which we regularly update as new discoveries are made.

2. **Alaskan Klee Kai that are fed a dry or processed diet can sometimes be prone to digestive sensitivities, which may be related to starch digestion. Does embark offer testing for the AMY2B gene, the gene responsible for starch metabolism?**

   Embark does not currently offer testing for the AMY2B gene, which is associated with starch metabolism. Research has shown that some northern and spitz-type breeds, including the Alaskan Klee Kai, may have fewer copies of this gene, which could influence how efficiently they digest starch. However, this trait has not yet been fully validated for use as a health screening test in dogs, and copy number variation in AMY2B is complex to measure reliably in a commercial setting. For now, digestive sensitivities in the breed are best managed through careful diet selection and veterinary guidance. Embark continually reviews new research, and if a validated test for AMY2B or other starch-related variants becomes available, we will evaluate adding it to our panel.

3. **For most dogs, digestive upset resolves once their diet is changed to one without starch. However, for those that continue to experience issues, are there any specific tests, beyond the standard veterinary recommendations, that should be considered? Are there additional genetic markers related to food intolerance that can be screened for?**

   Embark does not currently offer genetic testing for food intolerances beyond the health conditions already included in our panel. Digestive issues in dogs are usually complex and can be influenced by multiple genes as well as environmental factors, so there is no single genetic marker that can reliably predict food sensitivities. For most dogs, digestive upset improves with a change to a diet that better suits their needs, but if symptoms persist, the best next step

is to follow your veterinarian's guidance, which may include diet trials, allergy testing, or other diagnostic workups. In addition, Embark offers AnimalBiome's GI microbiome test, which can provide insights into gut health and help guide dietary management. Embark continually monitors new research, and if validated genetic markers for food intolerance become available, we will evaluate adding them to our test panel.

4. **If a breeder Embark tests their litter, is there a way to transfer ownership of one puppy's test results so that the new owner has access under their own Embark profile and the puppy would show up under their dogs?**

   Yes. If a breeder Embark-tests a litter, the results can be shared with the puppy's new owner by adding them as a co-owner on the dog's profile. This allows the new owner to view the results under their own Embark account, where the puppy will appear alongside their other dogs. More information is available on Embark's Help Desk, or you can reach out to our customer service team for step-by-step guidance.

5. **Is there a way to access results for relatives of the dogs we have tested?**

   The Relative Finder feature is only available with the Breed ID and Breed + Health kits, and cannot be added to the Breeder Kit at this time. We are working on building relatedness tools tailored specifically for the breeder community.

   If a dog is tested with a Breed ID or Breed + Health kit and is not on a Breeder account, making the dog's results public will allow others to view their relatives. For dogs tested on Breeder accounts, you can use the Pair Predictor feature or contact our Customer Experience team to request a Coefficient of Relatedness (COR) between two dogs.

   Please note that, due to our privacy policies, we can only share results directly with the pet owner or account holder unless we have their written permission.

6. **For the Pair Predictor feature, is there a way to select a dog that isn't under your Embark profile if the owner has Embarked their dog? Is there going to be a way to share results under the Embark profile's so that the pair predictor could be used more broadly?**

   If your pairing includes a dog not on your account, we recommend sharing your dog with the other owner or vice versa so you can use them both in Pair

Predictor. Please visit our Help Center for more detailed instructions on how: Can I add another owner or transfer a dog's profile to another person?

7. **Is there an option to display relatives in a way that is more like a family tree to see visually how they may be related?**

   Unfortunately, at this time we do not have the capability to change the way the Relative Finder results are displayed. We appreciate this feedback and have made note of it for future development.

8. **I have heard there is a Social Behavior gene/marker - WBSCR17 / GTF21. Is this something Embark is familiar with? Is there any information you could provide on how accurate results of something like this is or what the gene tells us? The Alaskan Klee Kai is a naturally shy and reserved breed. If there was a marker to help determine the likeness of sociability, it could be a very useful tool for breeders.**

   The WBSCR17 and GTF2I genes have been studied as possible contributors to sociability in dogs, but this research is still very early and no single marker has been shown to reliably predict behavior across breeds. Because behavior is complex and shaped by many genes as well as environment and early experiences, there isn't yet a validated genetic test that can tell us whether a dog will be more outgoing or more reserved. Embark is actively studying the genetics of behavior and we plan to introduce new tools in the future as the science becomes stronger and more reliable.

9. **We have been made aware of a well known breeder's puppy's DNA results coming back with results of 89.5% Alaskan Klee Kai and 10.5% Siberian Husky. This breeder has dogs closer to the breed's foundation stock, about 5-6 generations back. Could you explain why this may happen so we may read to our membership for them to better understand?**

   Most modern dog breeds were developed from the founding stock of other breeds, and over time breeders refined them into the purebred dogs we know today. When Embark analyzes a dog's DNA, the results are compared against our reference panel for each breed. For rare or relatively young breeds like the Alaskan Klee Kai, dogs closer to the foundation stock may not perfectly match the panel, which can sometimes appear as a small percentage of another breed. This does not mean the dog isn't purebred, and ancestry results should never be used by breed clubs or registries to determine purebred status. Historic imports, bloodlines not yet represented in our panel, and natural genetic diversity can all contribute to these findings. Importantly, Embark's ancestry results do not affect a dog's registration status, and health, traits, COI, and diversity results remain

accurate regardless of ancestry assignment. Our Help Desk also has articles with more detail on how to interpret these results.

10. **Is the Copper Toxicity gene breed specific? It looks like it shows up in other breeds, but there is no scientific evidence to show it means the same for all breeds? The majority, if not all Alaskan Klee Kai, that have been tested through Embark resulted in carrying 1 or2 copies of this gene with no confirmed diagnosis or specific set of symptoms.**

    The copper toxicosis variants that Embark tests for are not specific to the Alaskan Klee Kai, and research shows their effects can vary between breeds. While these variants are linked to copper storage disease in some breeds, many Alaskan Klee Kai carry one or even two copies without showing any signs of illness. Because there is no scientific evidence confirming that these variants cause disease in this breed, results should be considered an assessment of possible risk rather than a diagnosis. Embark is collaborating with researchers to better understand the impact of these variants across more breeds, and we encourage breeders to complete our annual health survey to let us know if their dogs are not showing clinical signs. Our Help Desk also has an article that explains what each result means and how breeders can use this information in their programs.

    Related Article: What do the Copper Toxicosis results mean for my dog or my breeding program?

11. **Is it possible to create or look into a potential breed specific dwarf gene with enough dogs to test? If so, how many dogs would need to participate or be potentially affected for a study?**

    At this time, Embark is not able to support individual research projects to look for new, breed-specific variants such as a potential dwarfism gene. Identifying novel genetic associations requires a carefully designed study with a large sample size, affected and unaffected dogs for comparison, and collaboration with geneticists. The exact number of dogs needed depends on the inheritance pattern and frequency of the condition in the breed. For breeders interested in pursuing research of this kind, we recommend connecting with academic groups such as Dr. Adam Boyko at Cornell University's College of Veterinary Medicine, who is one of our founders.

12. **What is the percentage of females that retained placentas and how often do they turn into a major problem?**

I'm not a boarded theriogenologist, but I can share some general information as a veterinarian. Retained placentas in dogs are considered relatively uncommon, though exact percentages are not well established in the literature. When they do occur, many cases resolve with appropriate veterinary care, but in some situations they can lead to serious complications such as infection (metritis) or delayed return to fertility. Because the true risk can vary depending on the individual dog, breed, and whelping circumstances, I always recommend reaching out to a boarded theriogenologist for further clarification and guidance specific to your breeding program.

13. **What are the dangers of breeding a dog with an umbilical hernia in terms of during pregnancy and whelping? Should it be avoided to breed 2 dogs together with umbilical hernias? If so, why?**

    Small, uncomplicated umbilical hernias are fairly common in dogs and often do not pose a risk during pregnancy or whelping. However, larger or complicated hernias can occasionally trap abdominal contents, which could create problems and may require surgical repair. Because umbilical hernias may have a hereditary component, it is generally not recommended to deliberately breed two dogs that both have hernias, as this could increase the likelihood of passing them on to puppies. For more detailed guidance on how this applies to your breeding program, I recommend reaching out to a boarded theriogenologist.

14. **If a female experiences uterine inertia once, is it likely a problem that will be ongoing, or is it worth it to try again? (Not just for a singleton)**

    Uterine inertia can have several different causes, including litter size, maternal factors, or breed predisposition. In some cases it may be a one-time event, while in others it can recur in future litters. Because the underlying cause and risk of recurrence can vary widely between dogs, it's best to have the female thoroughly evaluated before making breeding decisions. For case-specific guidance, I recommend consulting a boarded theriogenologist.

15. **Should a C-section nearly always be done for a singleton or are vets generally overly cautious?**

    Singleton litters can be higher risk because a single puppy may not produce enough hormonal signaling to trigger strong labor, and the puppy itself is often larger, which can increase the chance of dystocia. For these reasons, some

veterinarians recommend scheduling a C-section rather than waiting for natural whelping. That said, each case is different, and not every singleton requires surgical delivery. For tailored advice on whether a C-section is appropriate in your breeding program, I recommend consulting a boarded theriogenologist.

16. **Are some breeds truly just bad at AI pregnancies or is there something we are potentially doing wrong?**

    Success with artificial insemination (AI) depends on many factors, including semen quality, timing of insemination, type of AI performed (vaginal, transcervical, or surgical), and the reproductive health of the female. Some breeds do have lower conception rates with certain AI methods, but in many cases, challenges come down to technical details like timing ovulation precisely or ensuring semen is handled properly. Because it can be difficult to tease apart breed tendencies from management factors, I recommend consulting with a boarded theriogenologist for specific guidance and to optimize success in your breeding program.

17. **Is there a true benefit to surgical vs TCI? Does this change if the sperm count is higher? What is a good sperm count/motility?**

    Both surgical insemination and transcervical insemination (TCI) can be effective methods of artificial insemination. In most cases, TCI is preferred because it is less invasive while still placing semen directly into the uterus. Surgical insemination is sometimes considered when semen quality is very poor or other challenges are present, but it is not routinely necessary if TCI is available. For context, normal dog semen ranges in volume from about 1 to 30 mL per ejaculate and contains 300 million to 2 billion sperm, with more than 70% expected to be progressively motile and morphologically normal. Ideal number depends on semen type (fresh, chilled, or frozen) and the timing of insemination. For case-specific guidance on choosing between methods and interpreting semen quality, I recommend consulting a boarded theriogenologist.

18. **Do you generally count 63 days from the tie or from ovulation? If from ovulation, why might some repro vets still count from tie dates?**

    Pregnancy in dogs is about 63 days from ovulation, not from the breeding or tie date. This is because sperm can survive in the female reproductive tract for several days, and eggs also need time after ovulation to mature before they can be fertilized. Counting from the tie can therefore give variable results depending

on when ovulation actually occurred. Some reproductive veterinarians still reference tie dates as a practical estimate when precise ovulation timing (through progesterone testing or vaginal cytology) hasn't been done. For accurate whelping predictions, ovulation timing is the gold standard, and I recommend consulting a boarded theriogenologist for guidance tailored to your breeding program.

19. **What does the blue eye marker mean? We have results of bi-eyed dogs with 2 copies of blue. We also have results of blue eyed dogs with 1 copy of blue.**

    The "blue eye marker" refers to a duplication near the ALX4 gene that Embark discovered to be strongly associated with blue eyes in breeds such as Siberian Huskies and non-merle Australian Shepherds. This is a dominant but incompletely penetrant trait, which means that having one or two copies of the marker increases the likelihood of blue eyes, but does not guarantee them. That is why you may see dogs with two copies who are bi-eyed or brown-eyed, and dogs with only one copy who still have blue eyes. Embark reports this using a linkage test, which tracks nearby DNA markers associated with the variant. It's also important to know that blue eyes can arise from other genetic causes, including the merle gene, so more than one pathway can lead to this trait.

    This is the published study regarding this gene mutation.

20. **How many C-sections is too many? Does it make a difference? Is it situationally dependent?**

    The number of C-sections a dog can safely have is situational and depends on factors like the dam's overall health, how well she recovered from prior surgeries, and whether complications occurred. Some dogs may safely undergo more than one C-section, while for others, even a single difficult surgery could make additional pregnancies risky. Each case should be evaluated individually, with the dog's long-term health and welfare as the top priority. For personalized guidance, I recommend consulting a boarded theriogenologist.

21. **Alaskan Klee Kai vary significantly in coat density and texture from one dog to the other. For example there can be a "standard"(short/short) coat in our breed that has significantly more density and softer or rougher texture than another "standard"(short/short) coat in our breed. The same can be said for "long" coats in the breed as well(long/long). Some long coats**

display very modest length while others display significantly longer, but genetically are the same for coats.

a. **What would cause such variation in the breed with genetically same coat types?**
b. **Is there a genetic difference to account for undercoat density/texture that also varies with the different coat types (s/s, s/l/ and l/l)?**

Coat length in dogs is largely explained by known variants in the FGF5 gene. This test reliably predicts overall coat length, but it does not capture all of the other features of a dog's coat, such as texture, density, or the exact degree of length within the "short" or "long" categories. Those qualities are influenced by additional genes and modifiers that have not yet been fully mapped. That's why two Alaskan Klee Kai with the same FGF5 genotype can still look quite different in coat density or softness. At this time, there is no genetic test that can distinguish those finer differences, but ongoing research may identify more coat-related modifiers in the future.

22. **We see some Alaskan Klee Kai coat's color and mask fade much quicker than others early on in their lives, is there a possible gene that would cause this?**

Coat color and mask intensity in dogs can be influenced by several known genes, but the speed at which these features fade or lighten over time is not fully explained by current testing. While Embark can identify major coat color genes (such as those for agouti, eumelanin, dilution, and white spotting), the degree of fading or mask change often comes down to additional genetic modifiers that are not yet mapped or available as tests. This means two Alaskan Klee Kai with the same reported color genetics may still age differently in how quickly their coat or mask lightens. At this time, there is no specific gene identified that predicts this kind of fading.

23. **We notice that on Embark results, numerous breeds have their own specific PRA tests. Since PRA is not unheard of in Alaskan Klee Kai, will Embark consider adding PRA test specific to this breed?**

Progressive Retinal Atrophy (PRA) is a group of inherited eye diseases with different genetic causes depending on the breed. Embark currently tests for multiple PRA variants, including PRA-prcd, which is the most widespread form across many breeds. While PRA has been reported in Alaskan Klee Kai, we have

not identified any dogs in our database with the PRA-prcd variant, and no other PRA variant has been validated or confirmed as specific to the breed at this time.

Because PRA is genetically heterogeneous, different breeds can have their “own” PRA variant, but unless a causal mutation is published and validated in Alaskan Klee Kai, there is not yet a specific PRA test we can add for this breed. Embark continually monitors the scientific literature and collaborates with researchers, so if a breed-specific PRA variant is identified and validated, we will evaluate adding it to our panel.

24. **Alaskan Klee Kai are a smaller breed, and like many other small breeds, tend to have longer lifespans and do not age in the same way as larger counterparts (for example a 7 year old Alaskan Klee Kai will often appear much younger than a 7 year old Siberian Husky). They typically reach full maturity at around 24 months of age, and provided a bitch is in excellent physical condition, what would be considered the upper age limit at which it remains safe and appropriate to breed her? As the breed generally does not exhibit geriatric onset until 11 to 12 years of age at the earliest, is six years old, commonly advised as the upper limit for larger breeds, still the guideline to follow even in a fit and healthy Alaskan Klee Kai?**

    Smaller breeds like the Alaskan Klee Kai generally live longer than large or giant breeds, which can allow for a potentially longer breeding window. However, all dogs, regardless of size, face increased health risks associated with pregnancy as they age. Many organizations place an upper age limit of around 8 years for breeding females. Since a dog’s suitability for breeding depends on many factors including overall health, reproductive history, and the specific risks of pregnancy and whelping, it is highly recommended to consult a theriogenologist for personalized guidance.