

TO: LCA Board of Directors  
 FROM: LCA Breeding Committee  
 DATE: April 3, 2011  
 RE: BC Recommendation & Reasoning on LPN1 Testing

**RECOMMENDATION:**

That LPN1 testing be an optional, but recommended CHIC test, and that it is strongly recommended that one dog in each breeding pair be clear (N/N), consistent with the Union’s recommendation. (See below. Breedings in red are strongly discouraged):

Parent's genotypes	Probability for N/N-offspring	Probability for D/N-offspring	Probability for D/D-offspring
N/N X N/N	100 %	0 %	0 %
N/N X D/N	50 %	50 %	0 %
<b>N/N X D/D</b>	<b>0 %</b>	<b>100 %</b>	<b>0 %</b>
<b>D/N X D/N</b>	<b>25 %</b>	<b>50 %</b>	<b>25 %</b>
<b>D/N X D/D</b>	<b>0 %</b>	<b>50 %</b>	<b>50 %</b>
<b>D/D X D/D</b>	<b>0 %</b>	<b>0 %</b>	<b>100 %</b>

**REASONING BEHIND RECOMMENDATION:**

The goal is to eliminate LPN1 as a genetic disease in our breeding population. The only way to do this is to identify the very small number of carriers in the gene pool and make sure we follow through on any progeny until there are only clear offspring. The preferred and recommended method for identifying carriers by testing, with test results posted on CHIC (Although other means of determining clear status are discussed below)

**1. Making LPN1 an optional CHIC test will allow public posting of test results to existing CHIC profiles.**

In adopting the Member Practices the LCA placed a strong emphasis on encouraging breeders to make informed breeding decisions on health based upon public listing of health information on CHIC. Making LPN1 testing an optional test through CHIC is consistent with existing club practices, and will allow LPN1 testing information to be posted on each tested dog’s CHIC profile (Assuming the results are sent in).

According to the BC’s survey, over 90% of Breeders are already testing their breeding Leonbergers without a mandate. However, most test results have not yet been entered in CHIC. Simply sending existing test results to OFA would immediately create a large database of useful information. As a sign of support for the breeding community, and in order to promote a comprehensive database, the BC would suggest that the LCA consider paying to enter all LPN1 test results for a period of a year (\$15 per test).

**2. It is not necessary to make LPN1 a mandatory test because it is already strongly supported by the breeding community.**

As noted above, the BC’s survey shows that over 90% of Breeders are already voluntarily testing without a mandate. The survey also shows that just over 2/3 of breeders and stud

owners support making LPN1 a mandatory CHIC test, which shows they are willing to continue testing. Given this strong support, the BC feels an optional system is about as likely to result in a comprehensive, accurate, and public database as mandatory testing, but with the advantage of fewer complicating factors.

### **3. Requiring LPN1 testing for a CHIC number injects needless complication.**

Mandatory testing will require grandfathering of Leos that already have CHIC numbers, but CHIC profiles do not indicate the date a CHIC number was assigned. This could make it difficult to figure out exactly which dogs are grandfathered, and which are not. On the other hand, an optional testing program eliminates the need for grandfathering. Since the lack of a test result on the CHIC profile will be conspicuous, optional testing actually encourages registration of LPN1 test results for Leos that already have a CHIC number with the OFA, while grandfathering would discourage it.

Unlike other of our CHIC tests, the University of Minnesota does not automatically send test results to CHIC. Instead, the owner needs mail it to the OFA with a processing fee of \$15.00, adding additional time and inconvenience when trying to obtain a CHIC number. Would the LCA really wish to discipline a member whose dog has an LPN1 test result, but which only lacks a CHIC number due to the delays inherent in this system?

Breeders who have tested Leonberger puppies before they have registered names will have to retest in order to submit results to the OFA database. Required CHIC testing may discourage testing of litters. Optional testing also eliminates the need to fashion any sort of rule regarding frozen semen from dogs from the pre-CHIC era.

### **4. Although testing of each Leo in a breeding pair is preferred, it is not absolutely necessary to prevent the birth of LPN1 affected puppies.**

Whether mandatory or optional, the vast majority of breedings will involve Leonbergers of known genotype by testing. However, as long as one Leonberger per breeding pair is known to be clear by testing, LPN1 affected puppies cannot be produced (See genotype chart, above). Also, although not as reliable as actual test results, given what we know about pedigree accuracy, and carrier rate in the Leonberger population, the odds of producing an LPN1 affected puppy from breeding of a clear (N/N) Leo and a Leo of unknown genotype status, are less than 1 in 4,000. [4.4% pedigree error rate x 15% carrier rate of tested dog x 15% carrier rate of untested dog x 25% inheritance chance for puppy = .025%\*] These odds decrease significantly with each generation of screened breedings.

### **5. With information and education LPN1 will be a disease of the past soon:**

The majority of Leonbergers in the current breeding population already have a known, clear (N/N) genotype. A puppy born from two clear parents will be LPN1 clear as well. The incidence of this particular form of LPN is already quite low. Leonbergers have about a 4-to-6 year breeding window. Combined with a strong educational effort the BC

believes that the LPN1 gene mutation can be removed from the breeding population over that same period of time if the BC's recommendation is implemented.

\*Facts for the calculation of risk:

4.4% error rate comes from an electronic version of the "DNA ADVISORY COMMITTEE FINAL REPORT TO THE BOARD OF DIRECTORS" published by the AKC in September of 2002 after an audit of high volume breeders (puppy millers) to see if the DNA profiling program has helped to improve the registry. The math puts our error rate equivalent to that of millers, and the Leonberger registry should not be any less accurate than that, and possibly more accurate. The relevant paragraph from this paper states: "One-third of the litters registered by the AKC are produced by kennels subject to the Compliance Audit Program (i.e., they produce 7 or more litters per 8 year and are subject to AKC inspections). In 1998 the net percentage of litters excluded based on DNA testing was 10% (i.e., 90% integrity). In 2001 the net percentage of litters excluded was 4.4% (95.6% integrity). The integrity of AKC registration papers has been substantiated by the Compliance Audit Program."

The 15% Carrier rate is from the University of Minnesota's responses to the BC's questions, sent out in February.

The 25% inheritance chance is stated for LPN1 by the University of Minnesota at: <http://tinyurl.com/47cayp9>

The math is simple probability assuming randomness in pairing of Leonbergers. This series of videos explains the methodology: <http://www.khanacademy.org/video/probability--part-1?playlist=Probability>