

Introduction to the ICB Breeder Tool

[**http://bit.ly/ICB-BreederTool**](http://bit.ly/ICB-BreederTool)

Measures of Diversity & Relatedness

Essential concepts

- Inbreeding (genomic) (F or %)
- Inbreeding (fixation index) (Fis)
- Heterozygosity (Ho)
- Kinship

The ICB Breeder Tool uses standardized concepts and measures of genetic diversity and relatedness from population and conservation genetics.

Measures of Diversity & Relatedness

Essential numbers

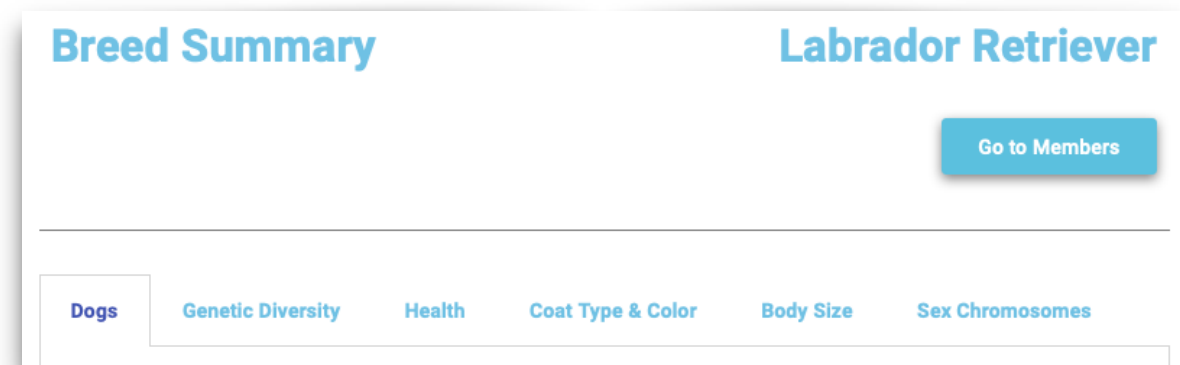
6.25% (0.625) First cousin cross

12.5% (0.125) Half-sibling cross

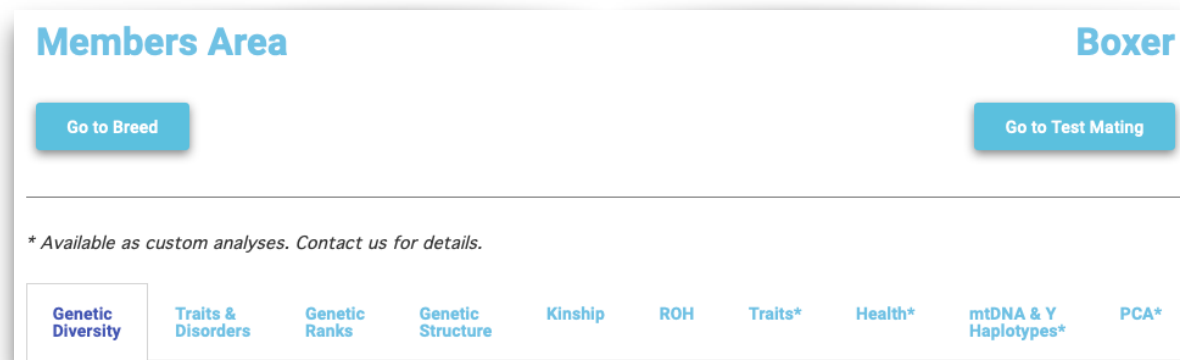
25% (0. 25) Full-sibling cross

Three Modules

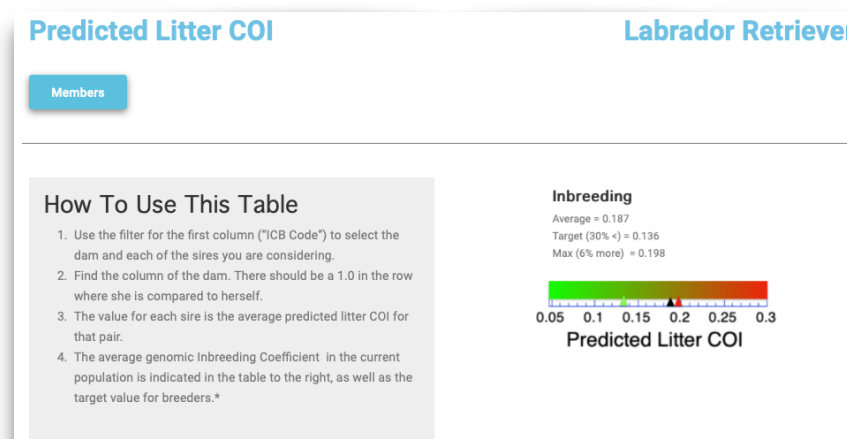
A) Genetic status of the breed



B) Status of Individuals



C) Test mating

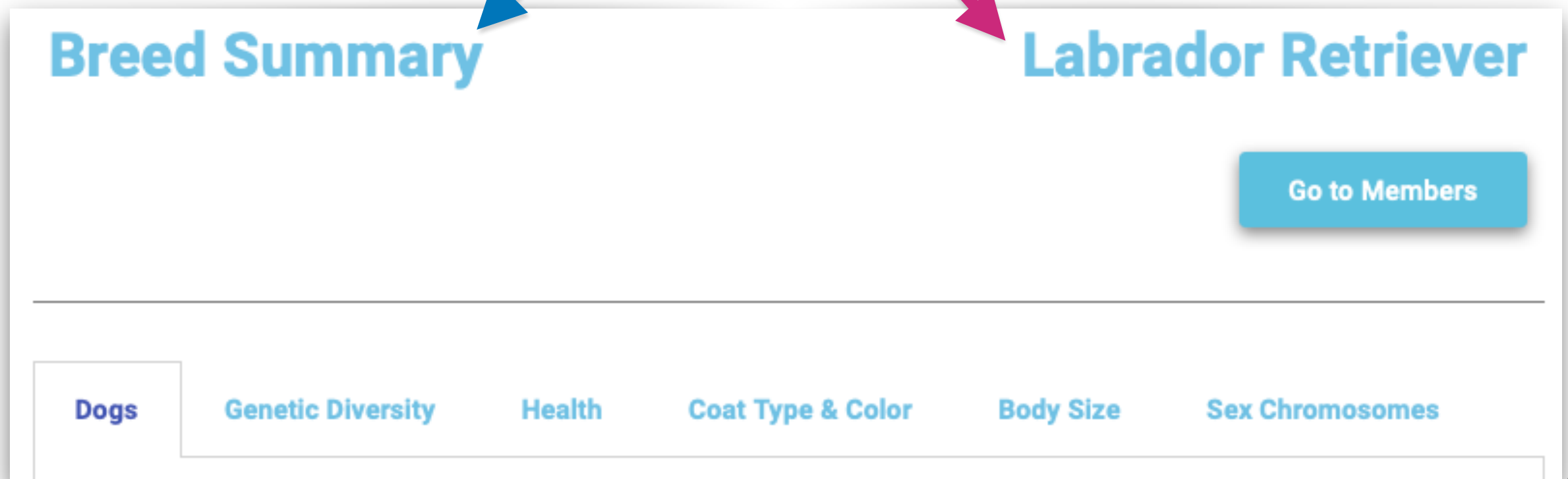


Rev. 1.4 10/16/18

A) Genetic status of the breed

Breed summary

- Genetic diversity
- Health
- Traits



Rev. 1.4 10/16/18

A) Genetic status of the breed

Dogs (inventory)

- Total number of dogs
- Anonymous dogs
- Known dogs

Breed Summary

English Springer Spaniel

[Go to Members](#)

Dogs

Genetic Diversity

Health

Coat Type & Color

Body Size

Sex Chromosomes

Inventory

Dogs currently in the database:

Total = 51

Anonymous dogs = 51

Known dogs = 0

A) Genetic status of the breed

Genetic Diversity

- Inbreeding
- Kinship
- Heterozygosity

Breed Summary

English Springer Spaniel

[Go to Members](#)[Dogs](#)[Genetic Diversity](#)[Health](#)[Coat Type & Color](#)[Body Size](#)[Sex Chromosomes](#)

Genetic Diversity

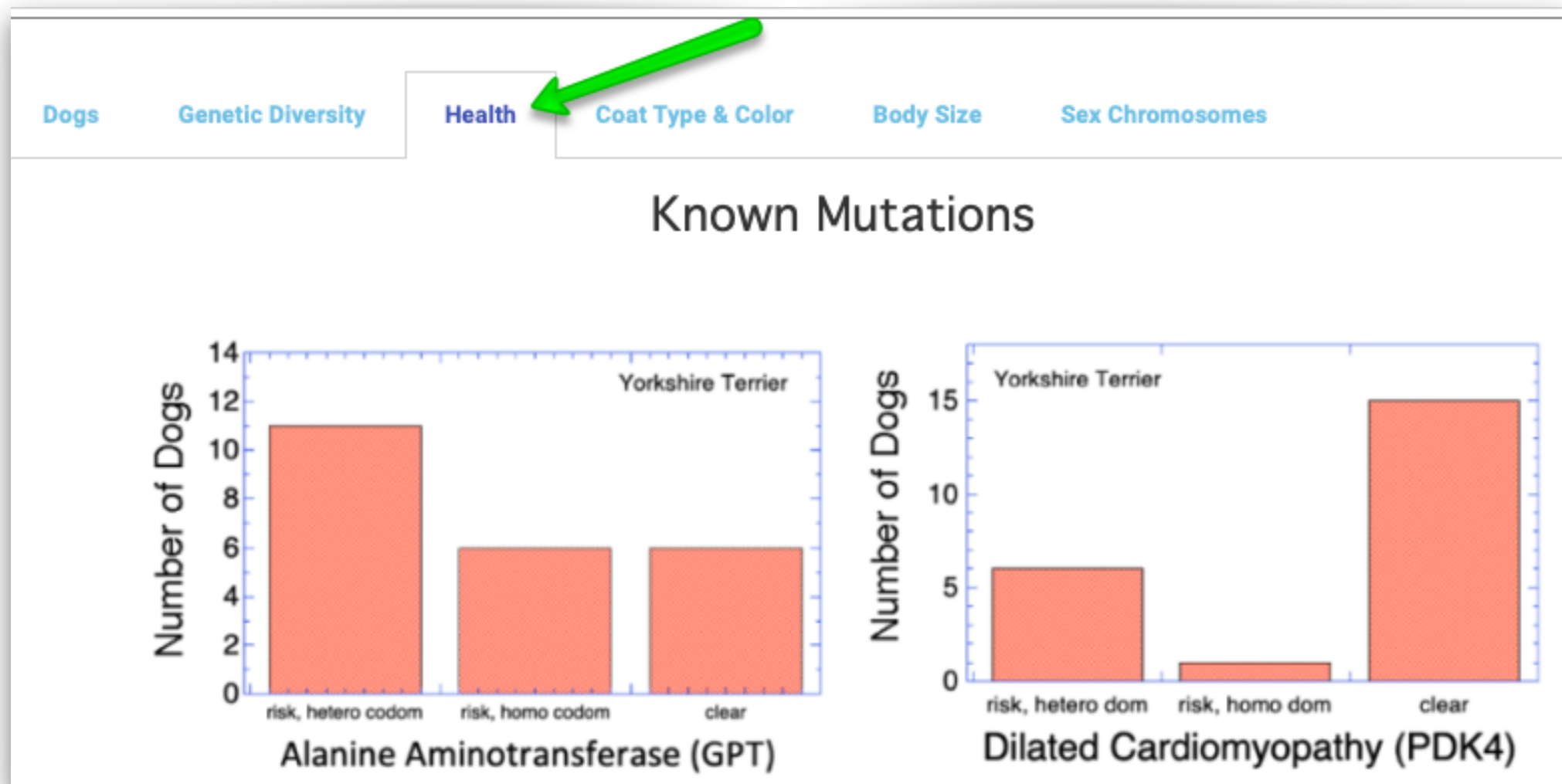
Number of Dogs = 51	Mean	Median	Maximum	Minimum
Heterozygosity	0.321	0.330	0.408	0.176
Genomic Inbreeding	0.251	0.228	0.562	0.019
Mean Kinship	0.040	0.028	0.114	0.020

Rev. 1.4 10/16/18

A) Genetic status of the breed

Mutation tests

- Genotype frequencies

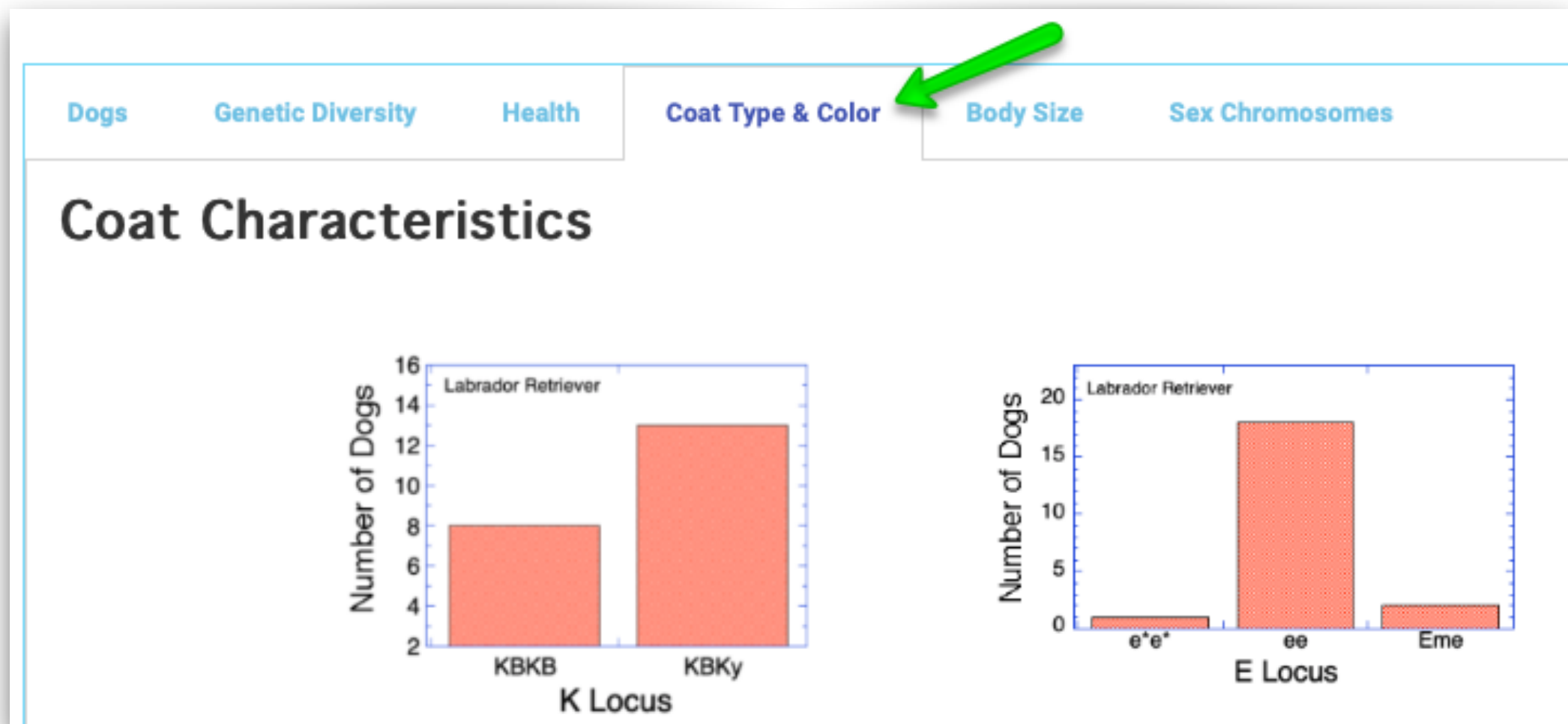


Rev. 1.4 10/16/18

A) Genetic status of the breed

Coat type & color

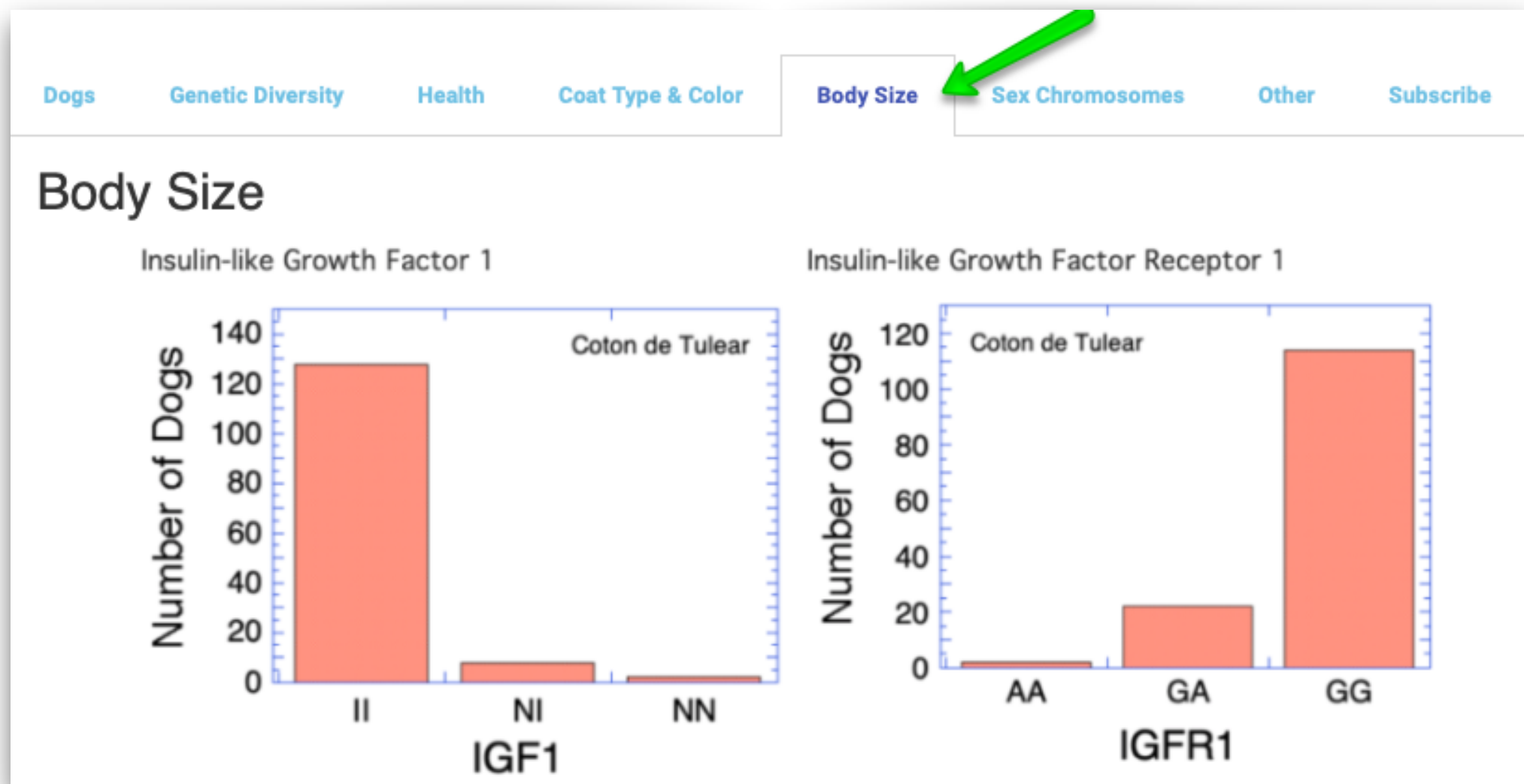
- Genotype frequencies



A) Genetic status of the breed

Body size

- Genotype frequencies

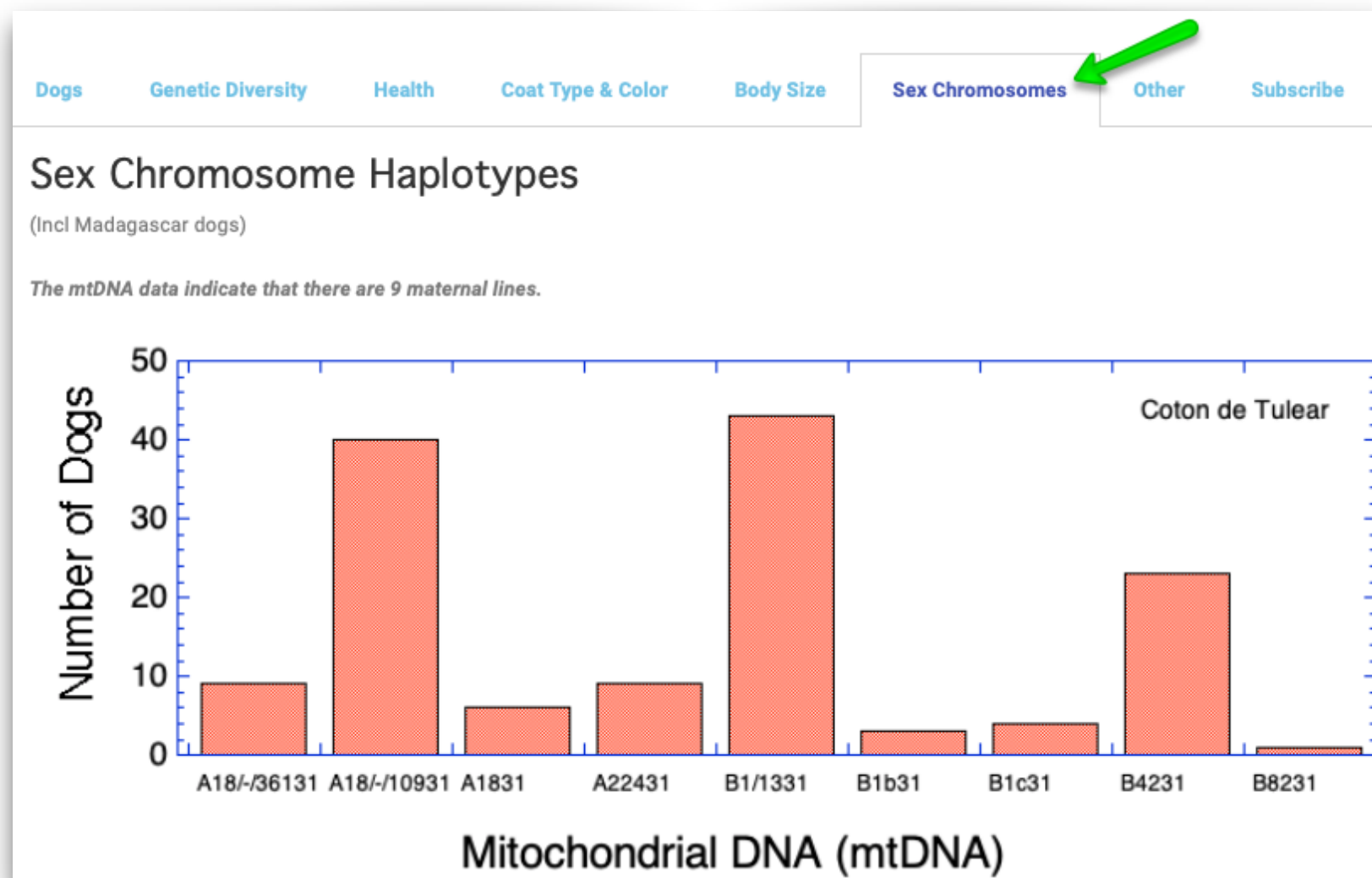


Rev. 1.4 10/16/18

A) Genetic status of the breed

Sex chromosomes

- Haplotype frequencies

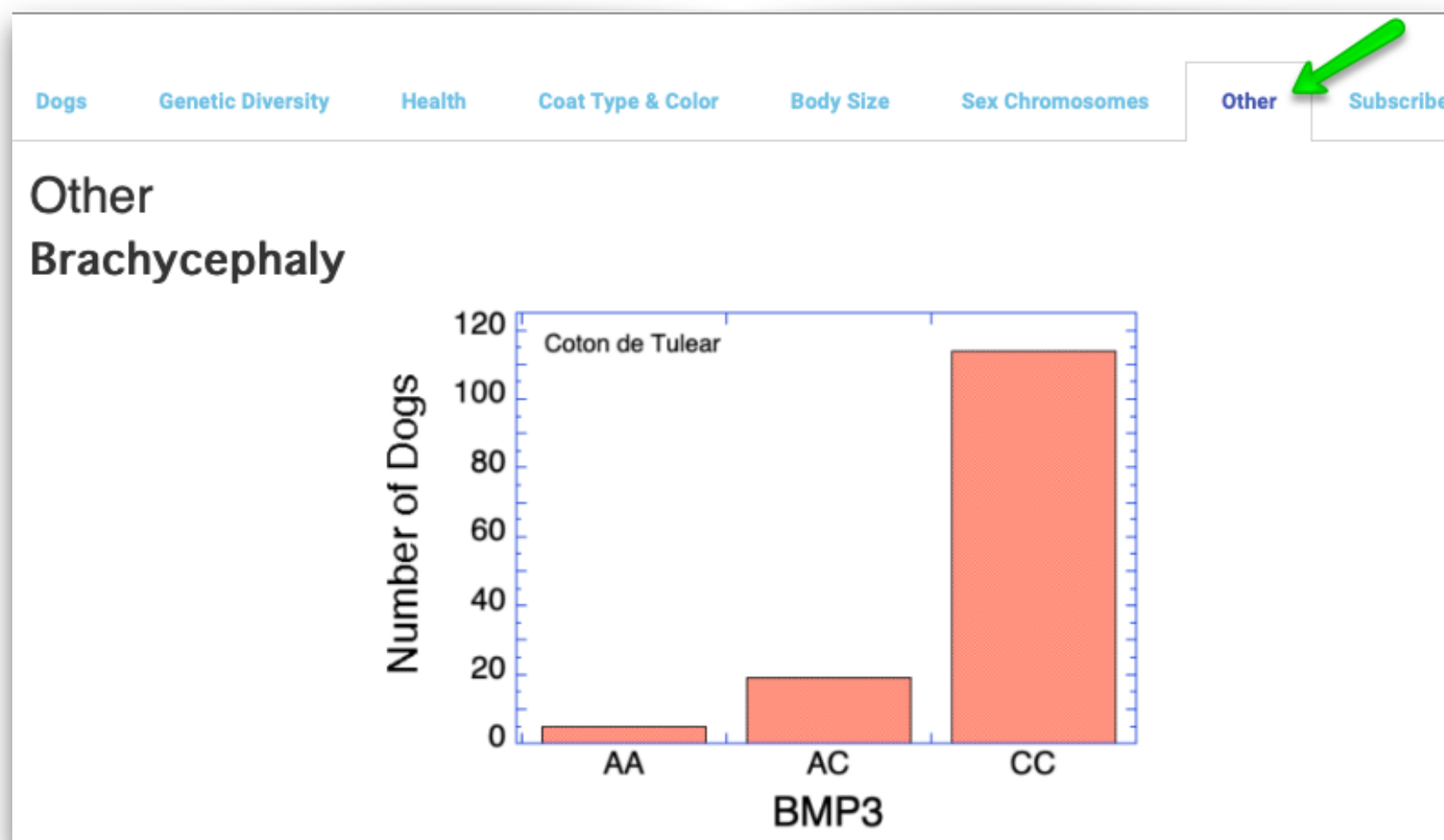


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A) Genetic status of the breed

Other traits

- As appropriate



A) Genetic status of the breed

Go to members area

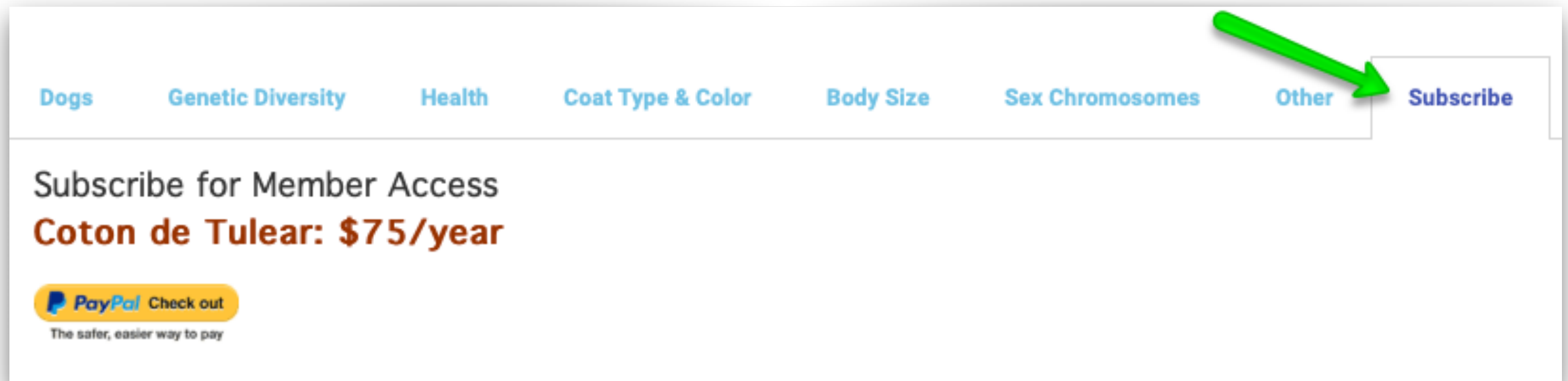
- subscription required



A) Genetic status of the breed


Become a Member!

- only \$75/year



Dogs Genetic Diversity Health Coat Type & Color Body Size Sex Chromosomes Other **Subscribe**


Subscribe for Member Access
Coton de Tulear: \$75/year

 **PayPal** Check out
The safer, easier way to pay

B) Genetics of individuals

Genetic statistics

- Genetic diversity
- Relatedness
- Genetic value
- Traits & mutations
- Population structure

Members Area 

Alaskan Malamute

[Go to Breed](#)

[Go to Test Mating](#)

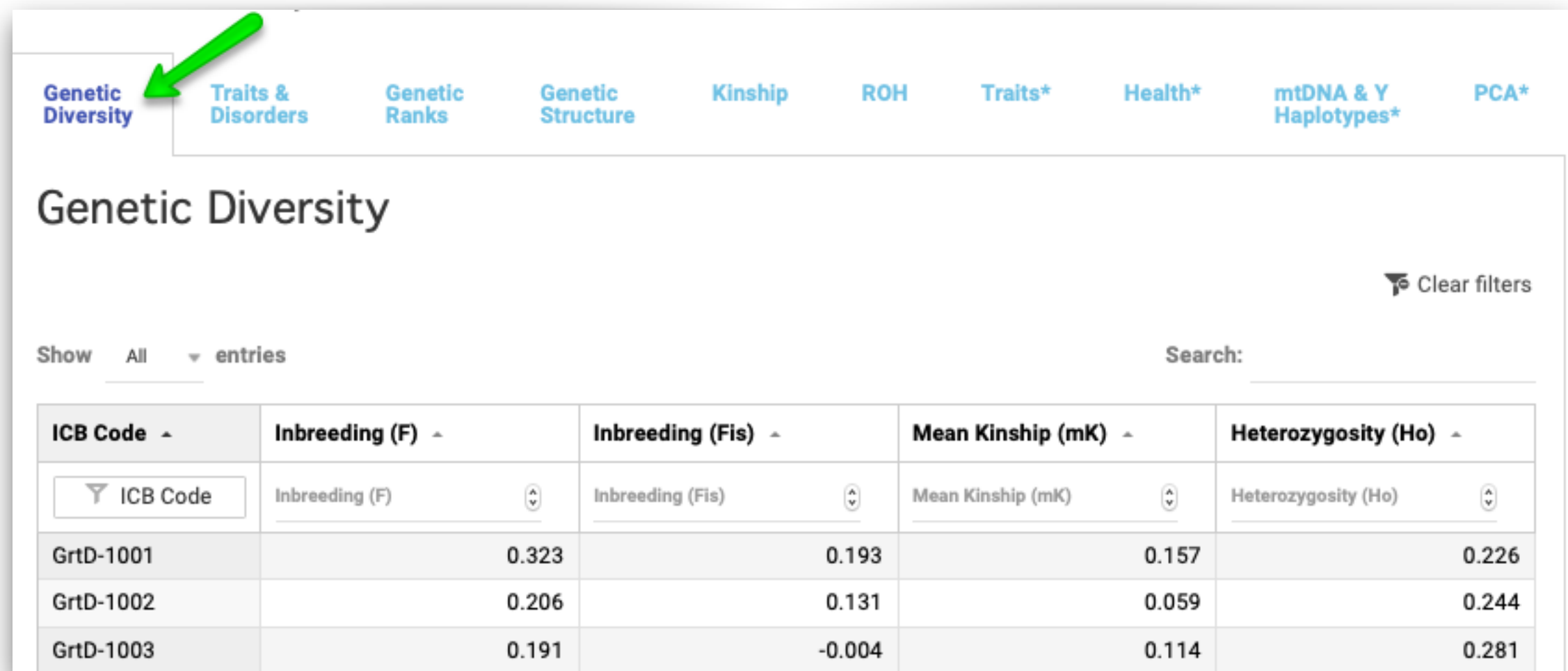
** Available as custom analyses. Contact us for details.*

Genetic Diversity	Traits & Disorders	Genetic Ranks	Genetic Structure	Kinship	ROH	Traits*	Health*	mtDNA & Y Haplotypes*	PCA*
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B) Genetics of individuals

Genetic statistics

- Genetic diversity
- Relatedness



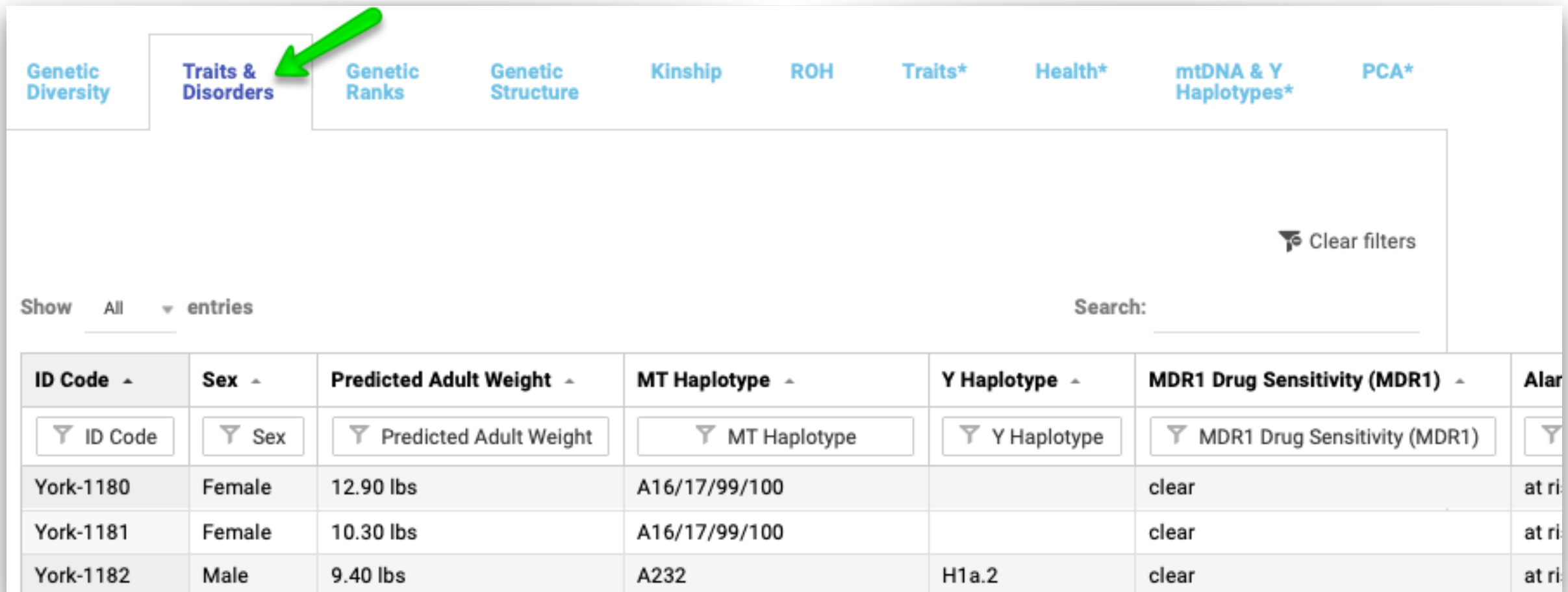
Genetic Diversity	Traits & Disorders	Genetic Ranks	Genetic Structure	Kinship	ROH	Traits*	Health*	mtDNA & Y Haplotypes*	PCA*
Genetic Diversity									
Clear filters									
Show All entries Search:									
ICB Code	Inbreeding (F)	Inbreeding (Fis)	Mean Kinship (mK)	Heterozygosity (Ho)					
ICB Code	Inbreeding (F)	Inbreeding (Fis)	Mean Kinship (mK)	Heterozygosity (Ho)					
GrtD-1001	0.323	0.193	0.157	0.226					
GrtD-1002	0.206	0.131	0.059	0.244					
GrtD-1003	0.191	-0.004	0.114	0.281					

Rev. 1.4 10/16/18

B) Genetics of individuals

Genetic statistics

- Genotypes of traits & disorders



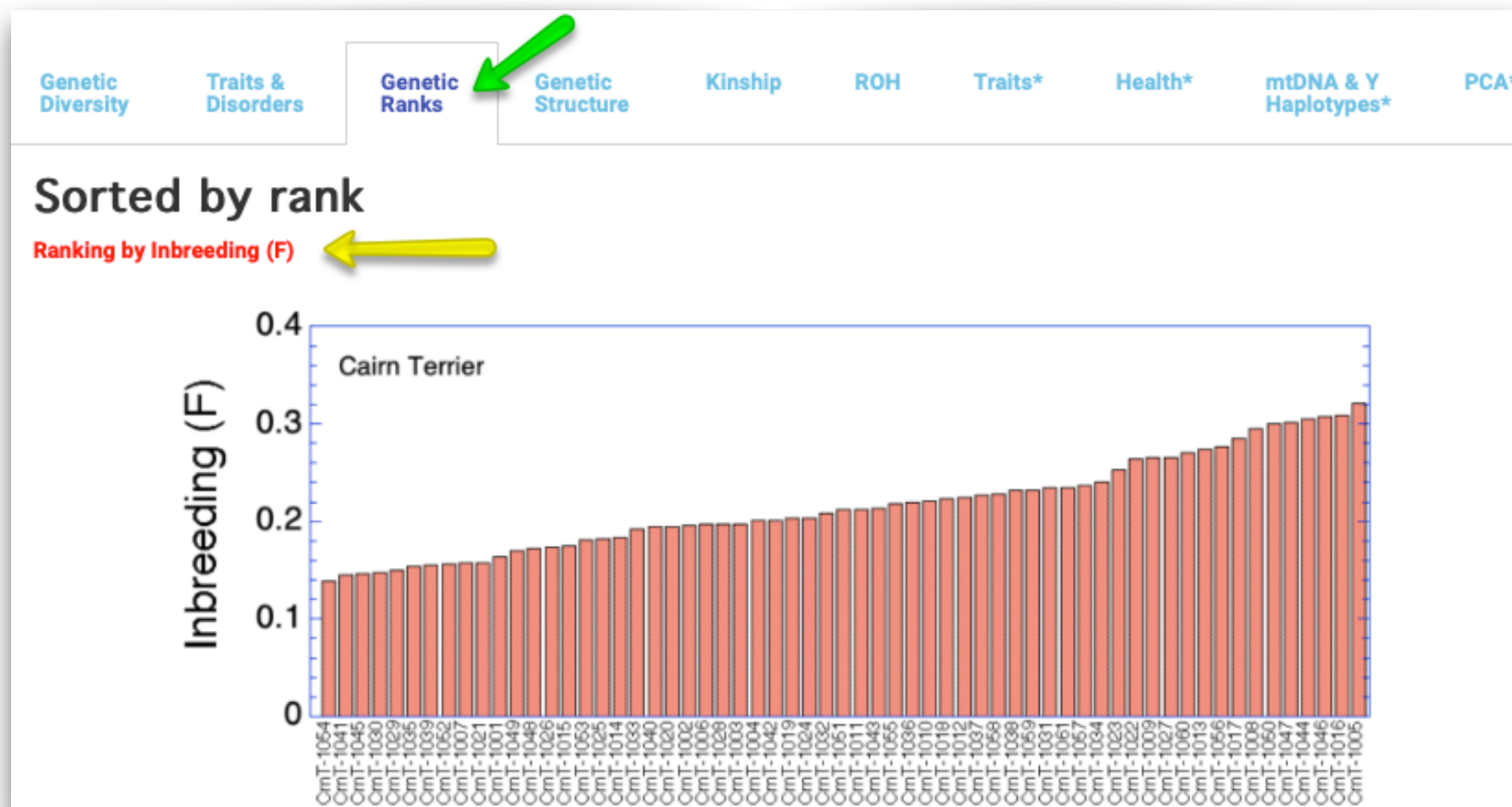
Genetic Diversity	Traits & Disorders	Genetic Ranks	Genetic Structure	Kinship	ROH	Traits*	Health*	mtDNA & Y Haplotypes*	PCA*
<div>Clear filters</div>									
Show All entries									
Search:									
ID Code	Sex	Predicted Adult Weight	MT Haplotype	Y Haplotype	MDR1 Drug Sensitivity (MDR1)	Alert			
<input type="text" value="ID Code"/>	<input type="text" value="Sex"/>	<input type="text" value="Predicted Adult Weight"/>	<input type="text" value="MT Haplotype"/>	<input type="text" value="Y Haplotype"/>	<input type="text" value="MDR1 Drug Sensitivity (MDR1)"/>	<input type="text" value="Alert"/>			
York-1180	Female	12.90 lbs	A16/17/99/100		clear	at risk			
York-1181	Female	10.30 lbs	A16/17/99/100		clear	at risk			
York-1182	Male	9.40 lbs	A232	H1a.2	clear	at risk			

Rev. 1.4 10/16/18

B) Genetics of individuals

Genetic rankings

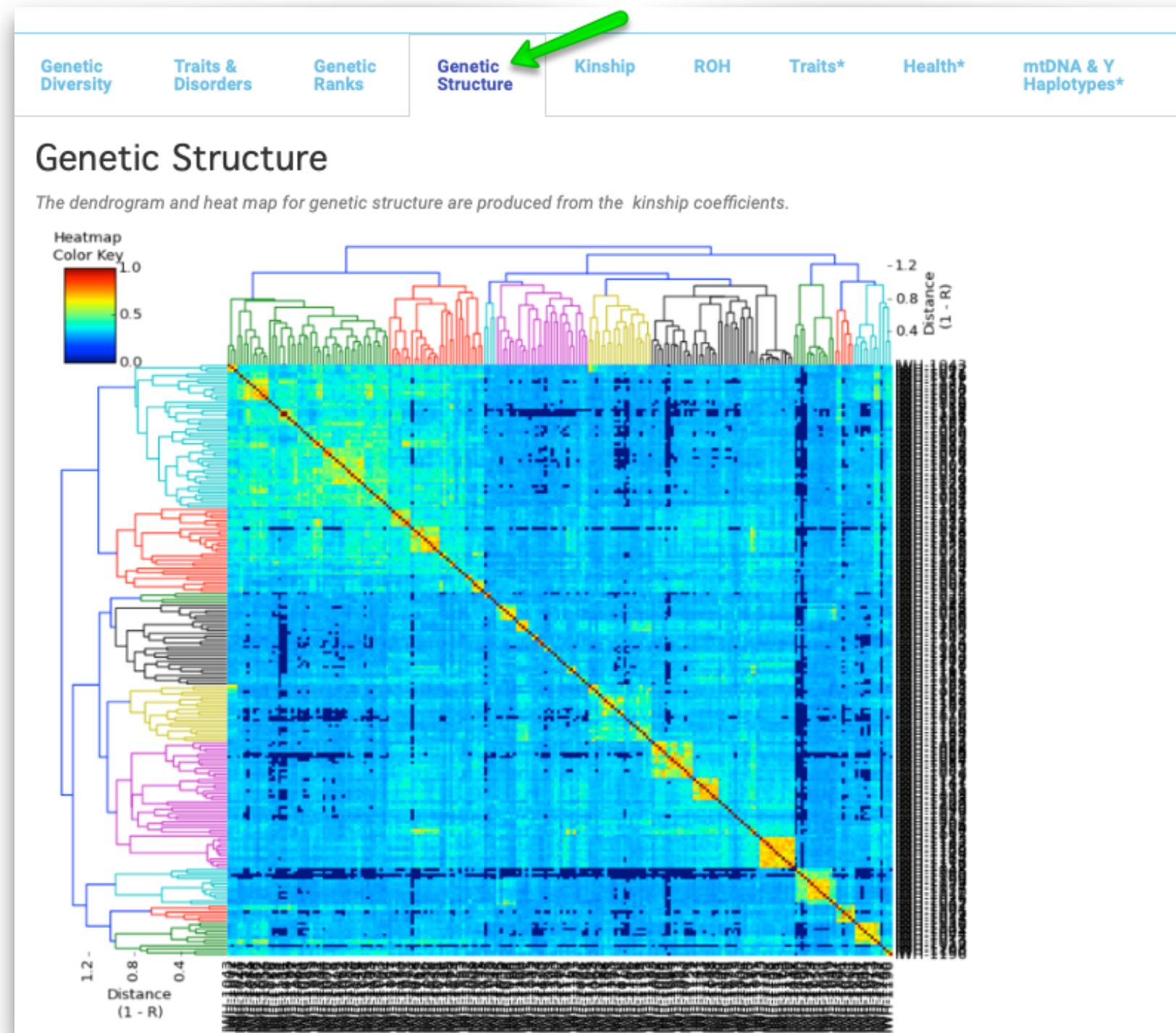
- Inbreeding & diversity
- Relatedness



B) Genetics of individuals

Genetic structure

- Heatmap
- Dendrogram



Rev. 1.4 10/16/18

B) Genetics of individuals

Kinship matrix

- Pairwise relatedness
- Color coded

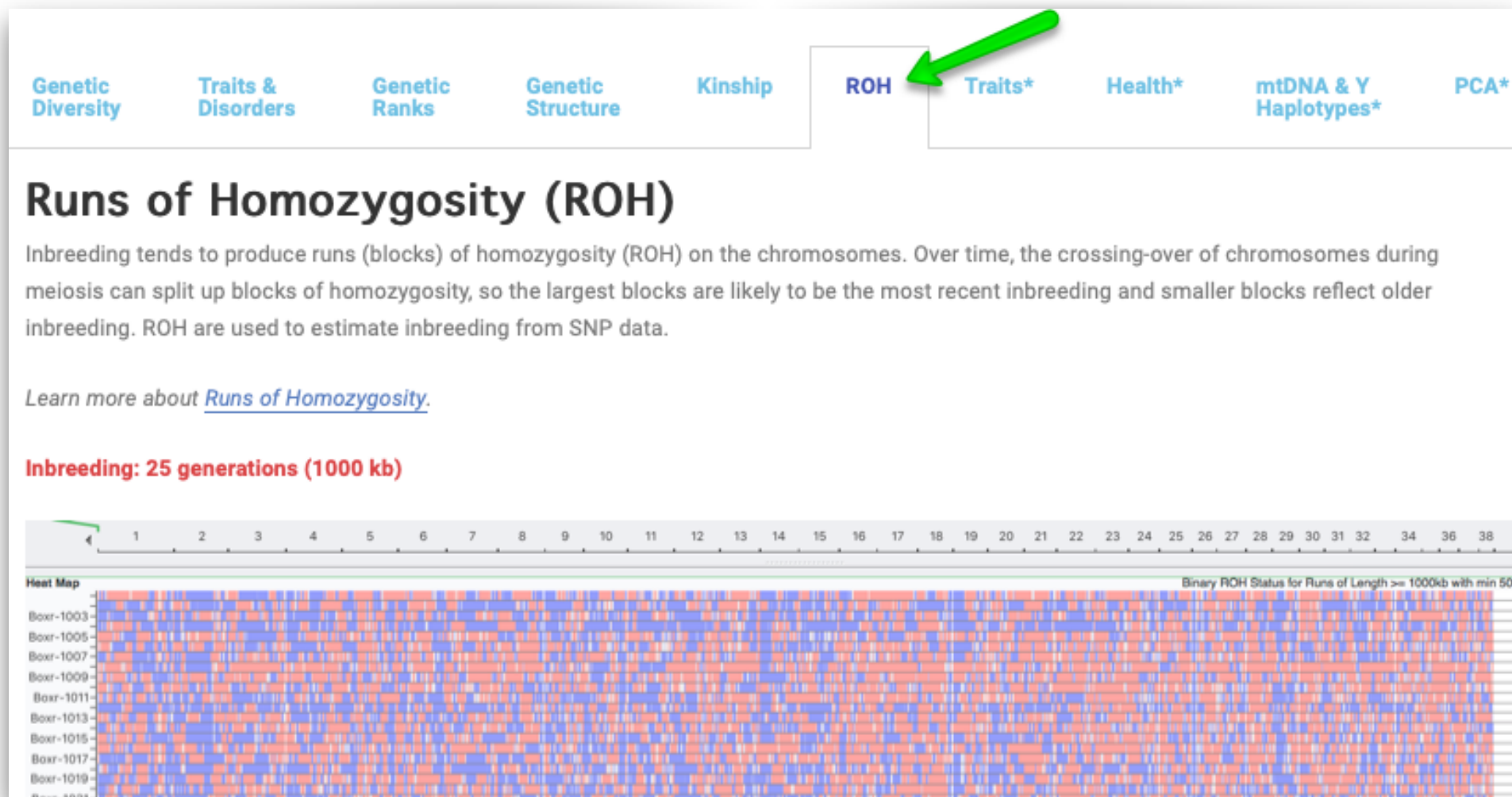


Rev. 1.4 10/16/18

B) Genetics of individuals

Runs of homozygosity

- Visualize inbreeding
- Color coded

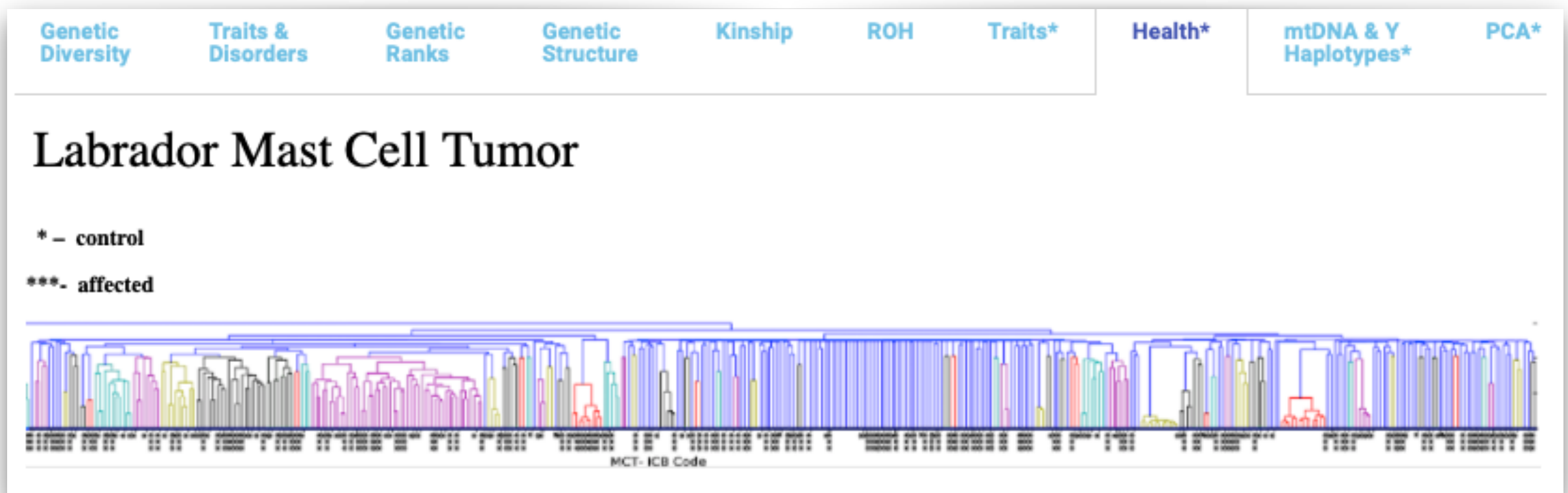


Rev. 1.4 10/16/18

B) Genetics of individuals

Disease risk

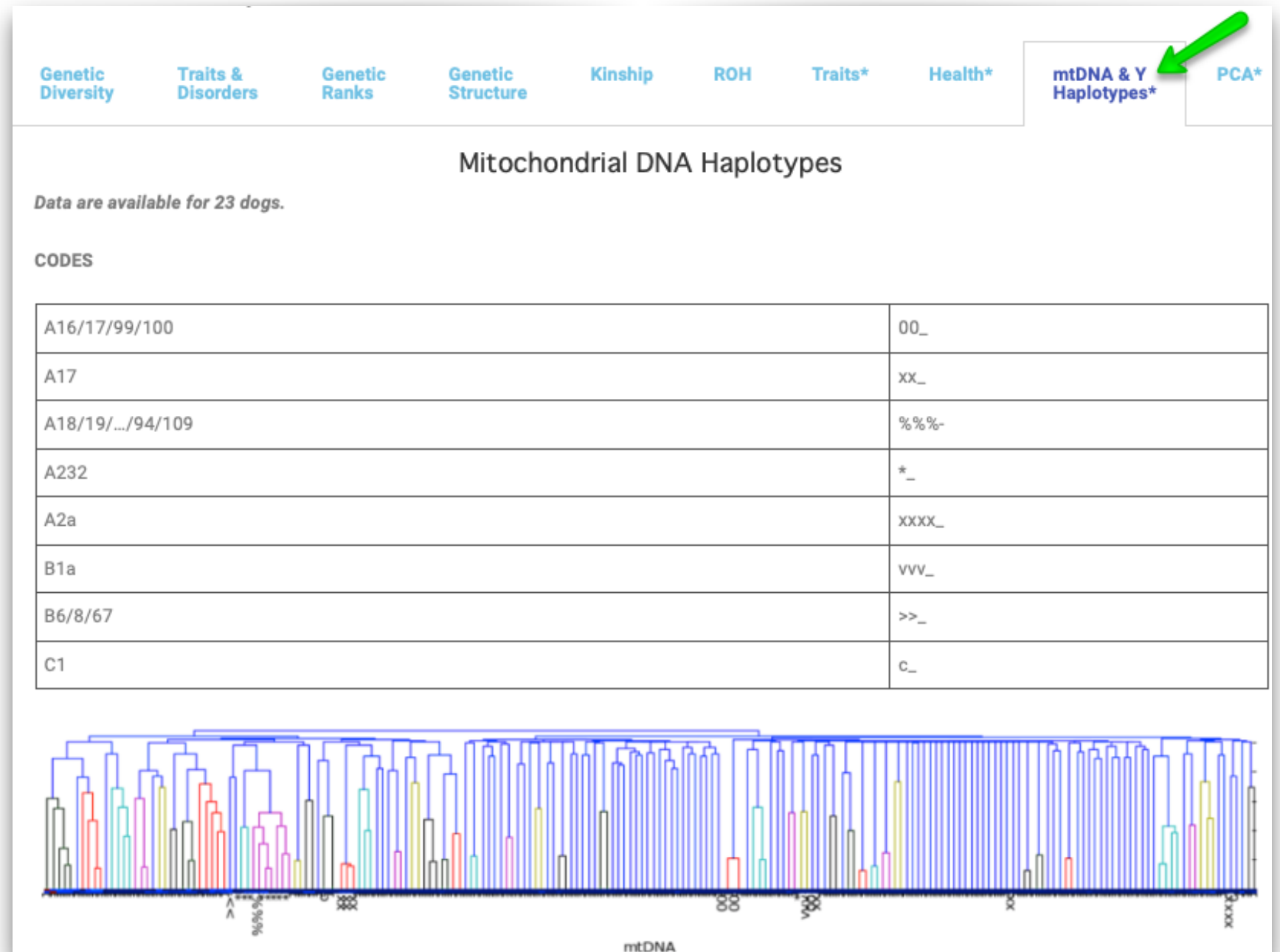
- Identify lineages
- Estimate frequency



B) Genetics of individuals

Trait distribution

- Identify lineages
- Estimate frequency

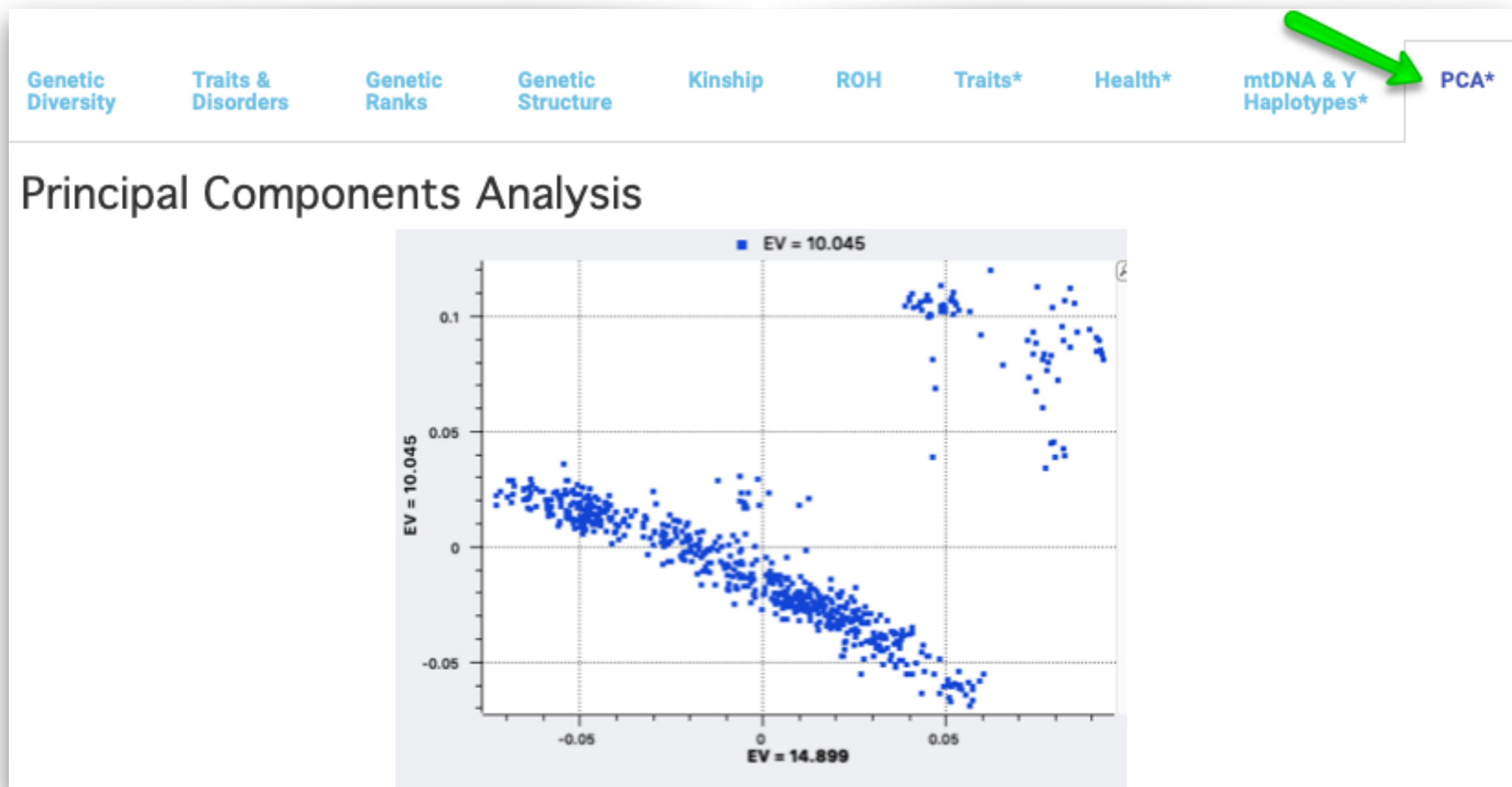


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B) Genetics of individuals

Genetic distance

- 2-D and 3-D relationships




Rev. 1.4 10/16/18

C) Test mating

Members Area

[Go to Breed](#)

German Shepherd

[Go to Test Mating](#)

** Available as custom analyses. Contact us for details.*

Genetic Diversity

Traits & Disorders

Genetic Ranks

Genetic Structure

Kinship

ROH

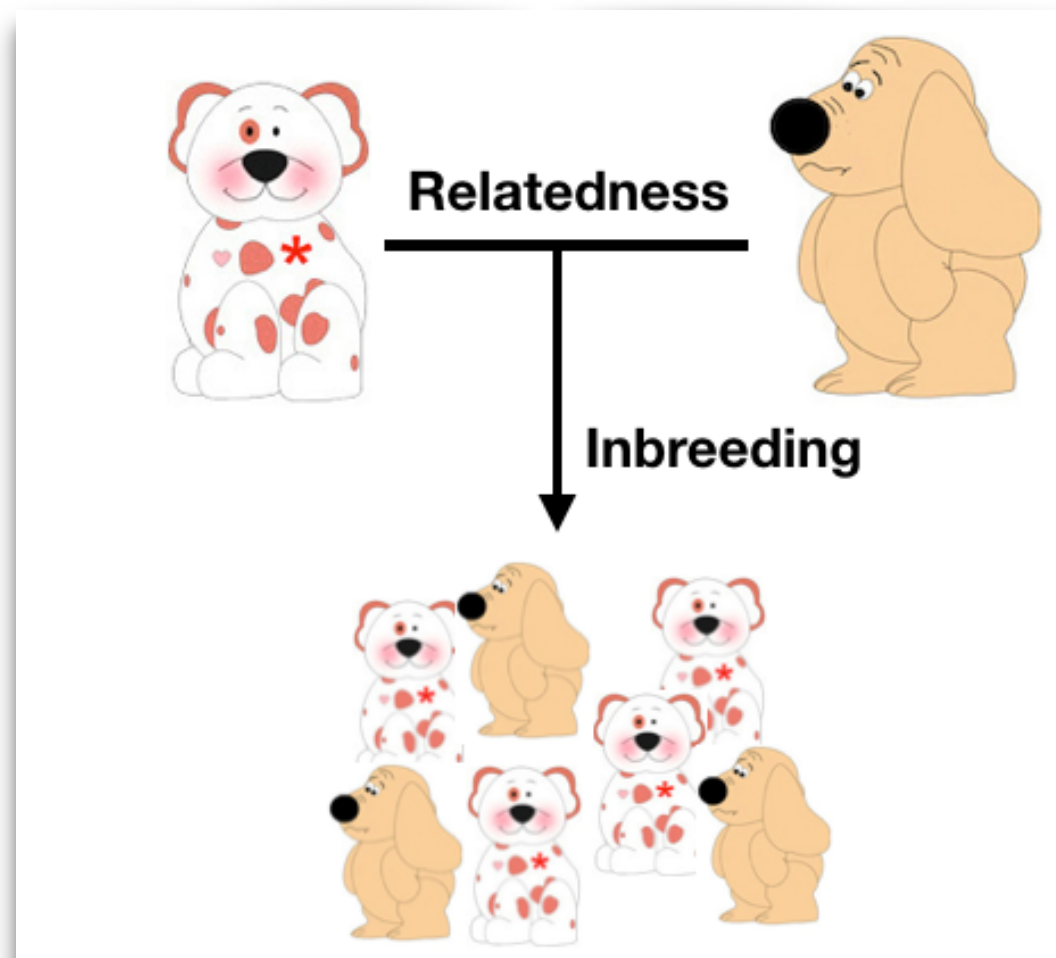
Traits*

Health*

mtDNA Hap

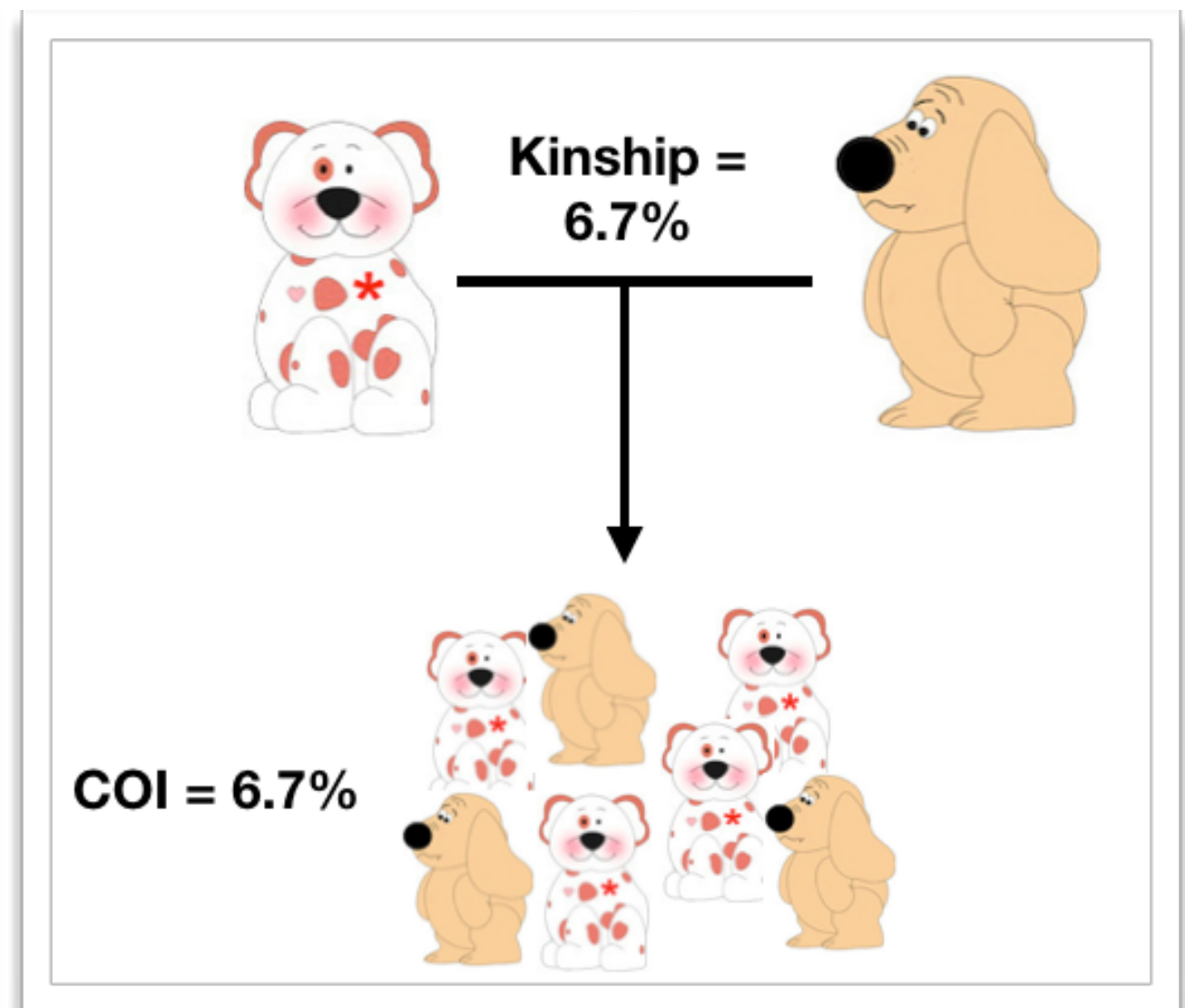
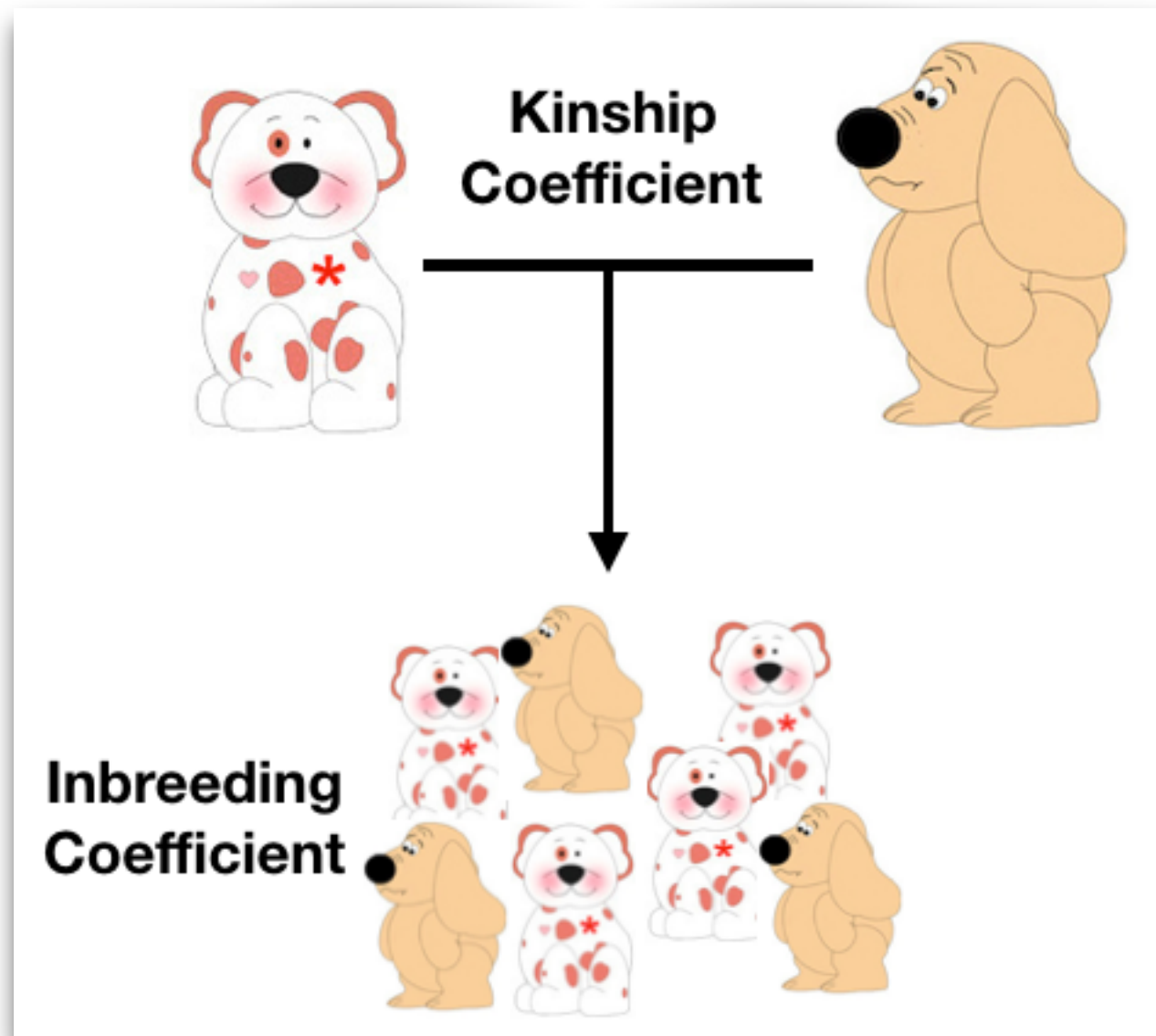
C) Test mating

- **Relatedness causes inbreeding**



Measures of Diversity & Relatedness

- Kinship Coefficient of parents = Litter COI*



C) Test mating

Kinship coefficient

- Genetic relatedness of two dogs
- Predicted COI of their offspring

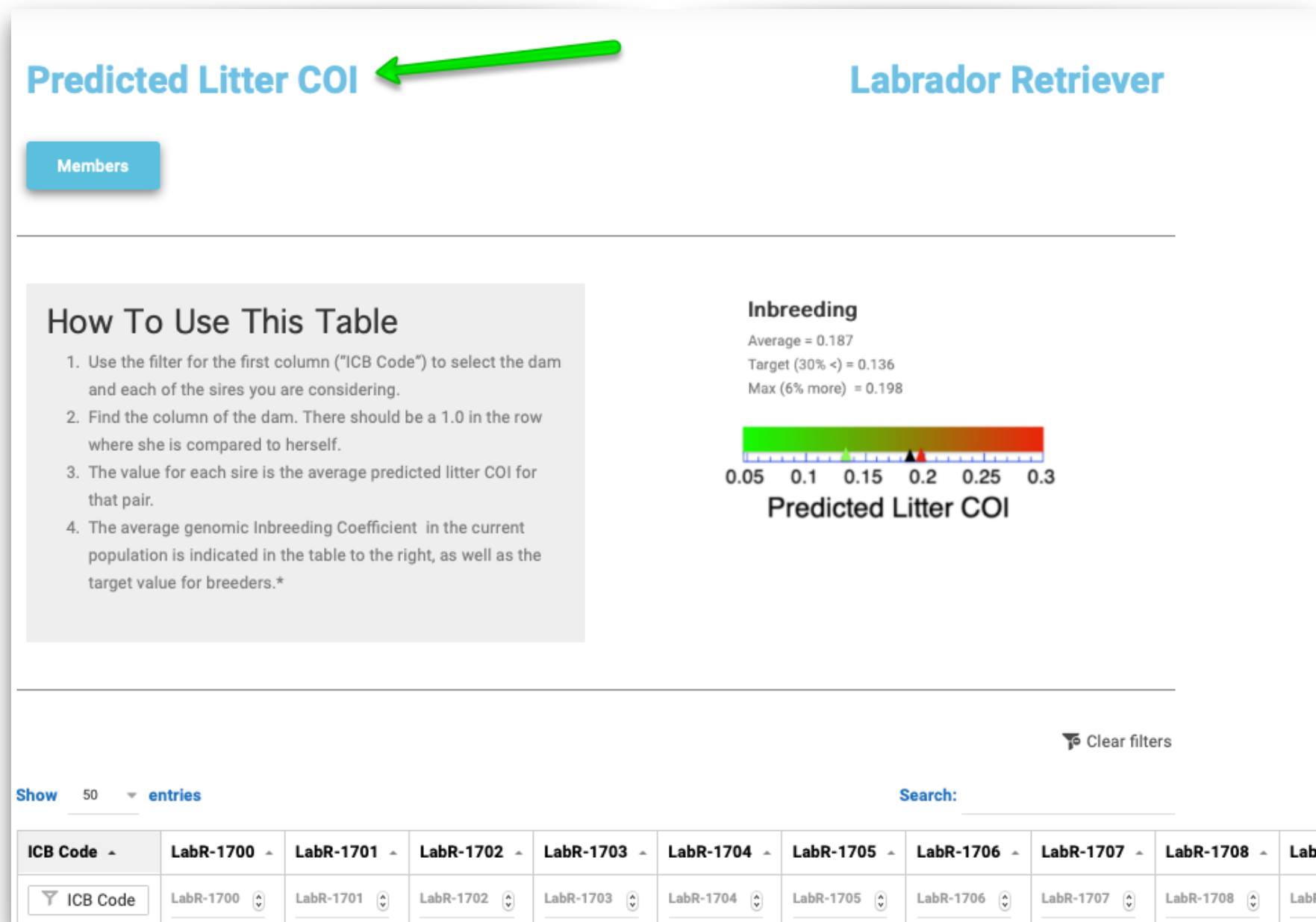
A litter produced by 1001 and 1003 has a predicted average COI of 0.58 (58%!)

0.25							
0.0625							
0							
	York-2001	York-1001	York-1002	York-1003	York-1004	York-1005	York-1006
York-2001	1.00	0.00	0.00	0.00	0.00	0.09	0.00
York-1001	0.00	1.00	0.00	0.58	0.00	0.11	0.00
York-1002	0.00	0.00	1.00	0.00	0.04	0.00	0.00
York-1003	0.00	0.58	0.00	1.00	0.00	0.14	0.00
York-1004	0.00	0.00	0.04	0.00	1.00	0.00	0.00
York-1005	0.09	0.11	0.00	0.14	0.00	1.00	0.00
York-1006	0.00	0.00	0.02	0.00	0.04	0.05	1.00
York-1007	0.00	0.00	0.00	0.00	0.00	0.00	0.00
York-1008	0.00	0.00	0.00	0.00	0.00	0.04	0.00

C) Test mating

Predicted litter COI

- Kinship matrix



Rev. 1.4 10/16/18

C) Test mating

Target litter COI

- Arbitrary target
- Approx. 30% reduction from mean
- “More is more”

How To Use This Table

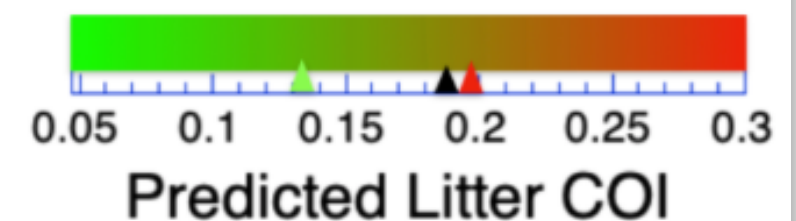
1. Use the filter for the first column (“ICB Code”) to select the dam and each of the sires you are considering.
2. Find the column of the dam. There should be a 1.0 in the row where she is compared to herself.
3. The value for each sire is the average predicted litter COI for that pair.
4. The average genomic Inbreeding Coefficient in the current population is indicated in the table to the right, as well as the target value for breeders.*

Inbreeding

Average = 0.187

Target (30% <) = 0.136

Max (6% more) = 0.198



C) Test mating

Mate selection

- Select potential sires
- Find column for the bitch
- Litter COI for each pair

Predicted Litter

Members

How To Use This

1. Use the filter for the first column and each of the sires you are interested in.
2. Find the column of the dam where she is compared to the sire.
3. The value for each sire is the average genomic Inbreeding Coefficient (COI) for that pair.
4. The average genomic Inbreeding Coefficient (COI) for the population is indicated in the table. *Target value for breeders.*

Show 50 entries

ICB Code	LabR-1700
LabR-1213	0.047
LabR-1220	0.000
LabR-1232	0.000
LabR-1240	0.090
LabR-1249	0.078
LabR-1258	0.049

ICB Code

- LabR-1190
- LabR-1195
- LabR-1198
- LabR-1201
- LabR-1204
- LabR-1207
- LabR-1210
- ☒ LabR-1213
- LabR-1216
- LabR-1219
- LabR-1222
- LabR-1225
- LabR-1228
- LabR-1231
- LabR-1234
- LabR-1237
- ☒ LabR-1240
- LabR-1243
- LabR-1246
- ☒ LabR-1249
- LabR-1252
- LabR-1255
- ☒ LabR-1258
- LabR-1261
- LabR-1264
- LabR-1267
- LabR-1270
- LabR-1273
- LabR-1276
- LabR-1279
- LabR-1282
- LabR-1285
- LabR-1288
- LabR-1291
- LabR-1294
- LabR-1297
- LabR-1191
- LabR-1193
- LabR-1196
- LabR-1199
- LabR-1202
- LabR-1205
- LabR-1208
- LabR-1211
- LabR-1214
- LabR-1217
- ☒ LabR-1220
- LabR-1223
- LabR-1226
- LabR-1229
- ☒ LabR-1232
- LabR-1235
- LabR-1238
- LabR-1241
- LabR-1244
- LabR-1247
- LabR-1250
- LabR-1253
- LabR-1256
- LabR-1259
- LabR-1262
- LabR-1265
- LabR-1268
- LabR-1271
- LabR-1274
- LabR-1277
- LabR-1280
- LabR-1283
- LabR-1286
- LabR-1289
- LabR-1292
- LabR-1295
- LabR-1298
- LabR-1192
- LabR-1194
- LabR-1197
- LabR-1200
- LabR-1203
- LabR-1206
- LabR-1209
- LabR-1212
- LabR-1215
- LabR-1218
- LabR-1221
- LabR-1224
- LabR-1227
- LabR-1230
- LabR-1233
- LabR-1236
- LabR-1239
- LabR-1242
- LabR-1245
- LabR-1248
- LabR-1251
- LabR-1254
- LabR-1257
- LabR-1260
- LabR-1263
- LabR-1266
- LabR-1269
- LabR-1272
- LabR-1275
- LabR-1278
- LabR-1281
- LabR-1284
- LabR-1287
- LabR-1290
- LabR-1293
- LabR-1296
- LabR-1299

How to Submit Data

Labrador Retrievers

Litter COI

0.2 0.25 0.3

Search:

LabR-1706	LabR-1707
0.000	0.000
0.000	0.000
0.000	0.000
0.035	0.000
0.013	0.000
0.000	0.000

Rev. 1.4 10/16/18

C) Test mating

Predicted litter COIs

- Choose potential sires
- Reduce table to dogs of interest

Clear filters

Show 50 entries Search:

ICB Code ▲	LabR-1700 ▲	LabR-1701 ▲	LabR-1702 ▲	LabR-1703 ▲	LabR-1704 ▲	LabR-1705 ▲	LabR-1706 ▲	LabR-1707 ▲	L
ICB Code	LabR-1700	LabR-1701	LabR-1702	LabR-1703	LabR-1704	LabR-1705	LabR-1706	LabR-1707	L
LabR-1213	0.047	0.000	0.062	0.000	0.000	0.000	0.000	0.000	
LabR-1226	0.091	0.043	0.056	0.000	0.058	0.058	0.060	0.000	
LabR-1228	0.016	0.015	0.042	0.000	0.049	0.049	0.000	0.000	
LabR-1236	0.053	0.000	0.050	0.000	0.074	0.074	0.000	0.000	

Showing 1 to 4 of 4 entries (filtered from 469 total entries)

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C) Test mating

Strategy

- Be aware of the genetic status of the breed
- Preserve breed genetic diversity
- Preserve rare alleles
- Reduce frequency of known mutations
- Improve heterozygosity (view ROH)
- Consider genetic value

