

Supplementary material

Supplemental Figure S1. Genewise alignment of human and dog *PRDM9*. Coding mutations, including one premature stop codon and four frameshift mutations, are highlighted in yellow.

Supplemental Figure S2. Clustal W2 alignment of *PRDM9* exon 7 in the boxer reference, all 15 sequenced dogs and the two wolves. Three results are noteworthy in this alignment: (1) All sequences analyzed are in frame with the sequence of the boxer reference individual showing that the two frameshift mutations that we observe in the boxer are common to all dogs and wolves analyzed here. (2) Nonhomologous recombination in Rough Collie has likely caused a gene conversion event between two zinc fingers, manifesting in five point mutations (positions 717, 719, 720, 739 and 741) between the Rough Collie and all other breeds. Although this event lacks functional meaning in a dead gene, it serves as an example of how the zincfingers of *PRDM9* can change rapidly through gene conversion. (3) The 3' end of *PRDM9* exon 7 in the boxer assembly ("Genome_ref_seq_Boxer") is likely wrong as it includes a 6 bp spurious insertion relative to all other sequences in this alignment (including the boxer that we sequenced).

Supplemental Figure S3.

Genewise alignment of panda *PRDM9* DNA and human *PRDM9* shows no loss of function mutations in panda *PRDM9*.

Supplemental Figure S4. Genewise alignment of cat *PRDM9* DNA and human *PRDM9* shows no loss of function mutations in cat *PRDM9*.

Supplemental Figure S5. Genewise alignments of Black backed Jackal and human, Red Fox and human, Bush Dog and human, Golden Jackal and human and African Wild Dog and human, respectively. All alignments involve human *PRDM9* protein sequence and canid *PRDM9* exon 7 DNA sequence. Frameshift mutations, highlighted in yellow, are evident in all canid species analyzed.

Supplemental Figure S6. Recombination rate variation, inferred using *interval*, across chromosomes 1-38 and X. X-chromosome rates are split in two panels. The panel marked "X_PAR" shows recombination rate variation across the pseudoautosomal part of X, while the panel marked "X_linked" shows rate variation across the remainder of X.

Supplemental Figure S7. Recombination rate as a function of distance from nearest gene. Average recombination rates for SNP pairs at similar distances (distances were put into 10 kb sized bins) from the nearest gene are plotted. Distance to nearest gene is measured from the midpoint of the SNP interval to either the 5' or 3' end, depending on which is closest. Two tick marks in the centre of the figure marks the average recombination rates in exons and introns, respectively.

Supplemental Figure S8. Decay of linkage disequilibrium (LD-decay), measured using r^2 , in real and simulated data. Solid lines show LD-decay in the 30 breeds used to estimate recombination rate variation in dog. Dashed lines show the LD-decay in data simulated using a demographic model that includes our best estimate of the breed effective population size.

Supplemental Figure S9. Comparing recombination rates in the LD-based recombination map and a previously published linkage map for chromosomes 1-38. Recombination rates of the linkage map (blue lines) and our LD-based inference (red lines) have been averaged across 5Mb windows prior to plotting. We rescaled population genetic estimates by estimating the effective

population size (N_e) of dog from comparing the complete extension of the overlapping portions of the two complete recombination maps.

Supplemental Figure S10. Sample-to-sample variation across recombination maps. Mean (solid line) and standard deviation (dashed lines) of 10 recombination maps covering a region of chromosome 1 (the region spans approximately 20Mb). Each map is based on an independent draw of 100 random chromosomes and inferred using *interval*. Dashed lines falling to the minimum of the y-axis are truncated and represent positions where the mean minus one standard deviation reaches 0.

Supplemental Figure S11. Comparison of two recombination maps. The recombination maps of two independent random draws of 100 chromosomes are plotted for a region of chromosome 1 (the region spans approximately 20 Mb).

Supplemental Figure S12. Power simulations to test the ability of *interval* to infer recombination rate variation in dog using no penalty for rate change ($bp=0$). Using a realistic demographic model we generated genotype data for 1 Mb regions centered around a hotspot of recombination with known intensity and width. Recombination rates outside the hotspot were kept uniform. 6 different scenarios were simulated in which hotspot intensity that varied from weak (20x background rate) to intermediate (100x background rate), were combined with three different hotspot widths (2, 10 and 100 kb). We used *interval* to infer recombination rates in 100 simulated data sets for each scenario and compared the average inferred rate (solid black line) to the uniform background rate (grey solid line), as well as the hotspot intensity (solid blue bars) used in the simulations. Dotted lines show the 2.5 and 97.5 percentiles of the sampling distribution. By not penalizing rate change in *interval* we increase the power to detect recombination rate variation, but at a cost of spurious rate variation.

Supplemental Table S1. Breed specific effective population sizes inferred using demographic modeling.

Supplemental Table S2. Repeat motif abundance, as inferred using RepeatMasker, in hotspot regions compared to cold regions. Divergent motif abundance in hot and cold regions was tested using a Fischer's exact test and p-values were corrected for multiple tests using a Bonferroni correction.

Supplemental Table S3. PCR and sequencing primers.

Supplemental Table S4. PCR conditions. A range of annealing temperatures indicates that a touchdown was used. The first number of cycles stated shows the duration of the touchdown. The second number of cycles shows the duration of the remainder of the program, which ran at the lowest temperature stated in the annealing temperature interval.

Supplemental Table S5. Breeds, and number of individuals for each breed, included in the recombination rate analyzes.

Supplemental File S1. Recombination rate map for the dog genome. This tab-delimited file described the complete recombination rate map generated using *interval*. The following information is available: column 1: chromosome, column 2: position of marker measured in kb, column 3: mean estimated recombination rate between this and the following marker, column 4 and 5: 2.5 and 97.5 percentiles of the rate estimates, respectively.

Supplemental File S2. Hotspot regions in the dog genome. This tab-delimited file contains information on the location of 4373 hotspot regions identified using *sequenceLDhot*. For each hotspot region the following information is available: column 1: chromosome, column 2:

hotspot region start, column 3: hotspot region end, column 4: hotspot region width, column 5:
likelihood ratio from *sequenceLDhot*.

Supplemental Figure 1.

Genewise: human versus dog DNA (no N-terminus: first 3 exons not detected in assembly using tblastn, BLAT, blastx)

PRDM9_HUMAN	101	VKPPWMALRVEQRKHQK		GMPKASFNS
		VKP W+A R+EQ KHQK		G+P+ +SN
		VKPSWVAFRMEQSKHQK		GIPRVPLSN
canFam2_dna	272	gacttggttaagcaaccaGTGAGTA Intron 1	AAGgacagctaa	
		taccgtctgtaagaaaa<0-----[323 : 2256]-0>	gtcgtctga	
		cattggacaggggtacgg	aacggaatc	
PRDM9_HUMAN	127	ESSLKELSR TANLLNASGSEQAQKPVSPSGEASTSGQHSRLKL		
		+SSLKELS TA LLN S EQ QK VS G+ASTSG H+R KL		
		KSSLKELSETAKLLNTSSPEQGQKSVSLPGKASTSGHHTRQKL		
canFam2_dna	2284	atatagttgagatcaaaacgcgcgtgtccgagaatgccaacat		
		acgtaatcaccattacggcaagaactctcgacgccgaacgaat		
		attggagaaaacggcgctcaggggaagcttaaatctatccaaag		
PRDM9_HUMAN	170			LKKETERKMYSLRERKGHAYKE
				LR+K+ E KMYSL+ERKG AY+E
		E:E[gaa]		LRRKDVEVKMYSLQERKGLAYQE
canFam2_dna	2413	GGTAAGAA Intron 2	CAGAAcaaaggggaataaccgaagcgtcg	
		<1-----[2414 : 3043]-1>	tggaatatatagtaagagtcaaa	
			cgagttaaggtcaaaagctacag	
PRDM9_HUMAN	194	VSEPQDDDDL		CEMCQNFFIDSCA
		VSEPQDDDDL		CE Q FFIDSC
		VSEPQDDDDL Y:Y[tat]		CEKXQTFFIDSC
canFam2_dna	3115	gagccgggtcTGTAAGTG Intron 3	CAGATtgatcattagata	
		tgacaaaaat <1-----[3146 : 3341]-1>	gaagacttttaggc	
		ccgcgttccc	tgagaccctcttt	
PRDM9_HUMAN	218	AHGPTTFVKDS AVDKGHPNRSALSLPPGLRIGPSGIPQAGLGVWNEASD		
		HGPPTFVKDS VDKG PN SAL+LPPGLRI S IPQAGLGVWN ASD		
		VHGPTTFVKDSEVDKGQPNHSALTLPGLRIRTSSIPQAGLGVWNXASD		
canFam2_dna	3383	gcgccatgagagggagccactgcacccgcaaaataaccggcgggtatgtg		
		tagcccttaagataagacaacctctccgtgtgccgtcacgtgtgaacca		
		ttgctatagctagcgaactcacctgcttgacaaacctgtgtaagcgact		
PRDM9_HUMAN	267	LPLGLHFGPYEGRITEDEEAANNYSW		
		LPLGLHFGPY+G+ITEDEEAAN+GYS		
		LPLGLHFGPYKGQITEDEEAANSYSC		L:L[tta]
canFam2_dna	3530	cctgcctgctagcaaggggggaagtttTTGTTGAGA Intron 4		
		tctgtatgcaagatcaaaaaccaggacg <2-----[3613 : 4012]		
		gagtactcctgcacaatagaccacct		
PRDM9_HUMAN	294	ITKGRNCYEYVDGKDK - -SWANWM		
		TKGRNCYEYVDGKDK SWANWM		
		!TKGRNCYEYVDGKDKDNSWANWM		
canFam2_dna	4010	CAGA2aagaattgtgggagagattgata		
		-2> caggagaaaatagaaaaacgcagt		
		cagacctgtgtagtgtctgacgg		

PRDM9_HUMAN	317		YVNCARDDEEQNLVAFQYHRQIF Y+NCARDDEEQ L VAFQYHRQIF YMNCARDDEEQ!L VAFQYHRQIF
canFam2_dna	4085	AGGTAAGGG Intron 5	CAGGtaatgaggggc2cggtctcacat <2-----[4087 : 5510]-2> atagcgaaaaa ttctaaagatt tgctcgtcggg agctatcggac
PRDM9_HUMAN	341	YRTCRI - -RPGCELLVWYGDEYQELGIKWSKWKELMAGR YRT R CELLVWYGDEY QELGIKWSKWK EL AG+ YRTGRT!GHQASCELLVWYGDEYSQELGIKWSKWKSELTAGK	
canFam2_dna	5580	tcagaa4gccgatgccgttggttacgcgaatgaataagcagga agcggc gaacggatttgagaaagaatgtaggagagatccga cactaa ttgccaggcgcgcgccgagccggacgggcgcaaga	
PRDM9_HUMAN	382		PKPEIHPCPSCCLAFSSQKFLSQ P PEIHPCPSC L FSSQKFLSQ PNPEIHPCPSCSL!FSSQKFLSQ
canFam2_dna	5710	GGTGGGCA Intron 6	CAGAAcagcactctttc2ttacatcac <1-----[5711 : 7478]-1> cacatacgccgct tcgaattga tcagatatacctg cctgacccg
PRDM9_HUMAN	406	HVERNHSSQNFPGPSARKLLQPENPCPGDQNEEQ-YPDPHSRNDKTKG H+E NH SQ +P S R+ +P++PCPG QNQ+QQ DP ND+ KG HLEHNHPSQILPRISVREHFRPKDPCPGCQNNQQQHSQSDPQRWDRAGK	
canFam2_dna	7549	ctgcacctcacccatgagctccagctcgtcacccccctgcctagagag ataaaaccattcgtctgaatgcaacgcggaaaaaaacacaggaagcag tgactcttgccaaataaatcaaatacattgtggggatttagcgtcatat	
PRDM9_HUMAN	454	QEIERSKLLNKRTWQREISRAFSSPPKGQMGSCRVGKRIMEEESRTGQ QE KER K L K QR ISRAFS+P KGQ C + EE S Q QEGKERFKPLPKSIRQRRISRAFSTPCKGQT-TCE- -GIVKEEPSAGSQ	
canFam2_dna	7696	cggagataactcaaaacaaatagttactagca atg gagaggcaggtc aagaagtactcagtgaggtcgtctcccgagac cga gttaaacgcgca agcaagcatgtataggaatagctccgcagaa gtg aaggagccacag	
PRDM9_HUMAN	503	KVNPNGNTGKLFVGVGISRIAKVKYGECEGQGFVSKSDVITHQRTHTGEKL K+NP +TGKLF GVG++RI +VKY CG+GF+ +S + HQRTHTEGE KLNPEDTGKLFKGVGMTRIIRVKYRGCGRGFNDRSHLSRHRTHTEGENP	
canFam2_dna	7834	atacggagattagggaaaaaagatagtgcgtagatccaaccaacaggac atacaacgattagtgtcgttgtaaggggggtaagcatggaagcacgaac agtagcacaacggaagaataacatactgaccttgatccatggacgagct	
PRDM9_HUMAN	552	YVCRECGRGFSWKSHLLIHQRIHTGEKPYVCRECGRGFSWQSVLLTHQR YVCRECGRGF +++L+IHQR HTGEKPYVCRECG GF +S L HQR YVCRECGRGFIHRTNLIHQRTHTEKPYVCRECG!GFIQRSNLSIHQR	
canFam2_dna	7981	tgtagtgcgtaacaacaacaggactgtagtgtgtacataacaacca atggaggggttagcatttaagcacgaacatggagg gtagcatgtaag ttcggtgactacaattcatgaacagggcctcgata ctaggatccatgg	
PRDM9_HUMAN	601	THTGEKPYVCRECGRGFSRQSVLLTHQRRHTGEKPYVCRECGRGFSRQS THTGEKPYVCRECGRGF+++S L HQR HT EKPYPVCRECGR F+R+S THTGEKPYVCRECGRGFTQRSTLNEHQRTHTTEKPYVCRECGRSFTRRS	

canFam2_dna	8127	acaggactgtagtgcgtagacatacagccaacaggactgtagtgatacat cacgaacatggaggggtcagcctaaaagcacaacatggaggggtcggc acagggttcgatgactaggatccacggacggggcttcggtgactagga
PRDM9_HUMAN	650	VLLTHQRRHTGEKPYVCRECGRGFSWQS L+THQR HTGEKPYVCRECGR F+ +S TLITHQRTHTGEKPYVCRECGRSFTKRS
canFam2_dna	8274	acaaccaacaggactgtagtgataaat cttcaagcacgaacatggaggggtcagc tccacggacagggttcggtgactagga

Supplemental Figure 2.

CLUSTAL 2.0.9 multiple sequence alignment

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Beagle      CCTAACCAGAGATACATCCATGTCATCTGCTCTCTGCTTCTCCAGT
Rottweiler  CCTAACCAGAGATACATCCATGTCATCTGCTCTCTGCTTCTCCAGT
Portuguese_water_dog CCTAACCAGAGATACATCCATGTCATCTGCTCTCTGCTTCTCCAGT
Rough_collie CCTAACCAGAGATACATCCATGTCATCTGCTCTCTGCTTCTCCAGT
Standard_poodle CCTAACCAGAGATACATCCATGTCATCTGCTCTCTGCTTCTCCAGT
Labrador_retriever CCTAACCAGAGATACATCCATGTCATCTGCTCTCTGCTTCTCCAGT
Swedish_wolf_21 CCTAACCAGAGATACATCCATGTCATCTGCTCTCTGCTTCTCCAGT
Bearded_collie CCTAACCAGAGATACATCCATGTCATCTGCTCTCTGCTTCTCCAGT
Snölandsströvare CCTAACCAGAGATACATCCATGTCATCTGCTCTCTGCTTCTCCAGT
Boxer        CCTAACCAGAGATACATCCATGTCATCTGCTCTCTGCTTCTCCAGT
Eurasian     CCTAACCAGAGATACATCCATGTCATCTGCTCTCTGCTTCTCCAGT
Swedish_wolf_34 CCTAACCAGAGATACATCCATGTCATCTGCTCTCTGCTTCTCCAGT
Genome_ref_seq_Boxer CCTAACCAGAGATACATCCATGTCATCTGCTCTCTGCTTCTCCAGT
Nova_Scotia_duck_tolling_retri CCTAACCAGAGATACATCCATGTCATCTGCTCTCTGCTTCTCCAGT
Dalmatian    CCTAACCAGAGATACATCCATGTCATCTGCTCTCTGCTTCTCCAGT
German_shepherd CCTAACCAGAGATACATCCATGTCATCTGCTCTCTGCTTCTCCAGT
Polish_lowland_sheepdog CCTAACCAGAGATACATCCATGTCATCTGCTCTCTGCTTCTCCAGT
Swedish_Elkhound CCTAACCAGAGATACATCCATGTCATCTGCTCTCTGCTTCTCCAGT
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Beagle      CAGAAATTCCTCAGCCAGCATTGGAAACAAACACCTTCTCAGATCCT
Rottweiler  CAGAAATTCCTCAGCCAGCATTGGAAACAAACACCTTCTCAGATCCT
Portuguese_water_dog CAGAAATTCCTCAGCCAGCATTGGAAACAAACACCTTCTCAGATCCT
Rough_collie CAGAAATTCCTCAGCCAGCATTGGAAACAAACACCTTCTCAGATCCT
Standard_poodle CAGAAATTCCTCAGCCAGCATTGGAAACAAACACCTTCTCAGATCCT
Labrador_retriever CAGAAATTCCTCAGCCAGCATTGGAAACAAACACCTTCTCAGATCCT
Swedish_wolf_21 CAGAAATTCCTCAGCCAGCATTGGAAACAAACACCTTCTCAGATCCT
Bearded_collie CAGAAATTCCTCAGCCAGCATTGGAAACAAACACCTTCTCAGATCCT
Snölandsströvare CAGAAATTCCTCAGCCAGCATTGGAAACAAACACCTTCTCAGATCCT
Boxer        CAGAAATTCCTCAGCCAGCATTGGAAACAAACACCTTCTCAGATCCT
Eurasian     CAGAAATTCCTCAGCCAGCATTGGAAACAAACACCTTCTCAGATCCT
Swedish_wolf_34 CAGAAATTCCTCAGCCAGCATTGGAAACAAACACCTTCTCAGATCCT
Genome_ref_seq_Boxer CAGAAATTCCTCAGCCAGCATTGGAAACAAACACCTTCTCAGATCCT
Nova_Scotia_duck_tolling_retri CAGAAATTCCTCAGCCAGCATTGGAAACAAACACCTTCTCAGATCCT
Dalmatian    CAGAAATTCCTCAGCCAGCATTGGAAACAAACACCTTCTCAGATCCT
German_shepherd CAGAAATTCCTCAGCCAGCATTGGAAACAAACACCTTCTCAGATCCT
Polish_lowland_sheepdog CAGAAATTCCTCAGCCAGCATTGGAAACAAACACCTTCTCAGATCCT
Swedish_Elkhound CAGAAATTCCTCAGCCAGCATTGGAAACAAACACCTTCTCAGATCCT
*****

Beagle      CCACGAAATCTGTAAAGAGAAATTTCCGACCAAAGATCCATGCCAG
Rottweiler  CCACGAAATCTGTAAAGAGAAATTTCCGACCAAAGATCCATGCCAG
Portuguese_water_dog CCACGAAATCTGTAAAGAGAAATTTCCGACCAAAGATCCATGCCAG
Rough_collie CCACGAAATCTGTAAAGAGAAATTTCCGACCAAAGATCCATGCCAG
Standard_poodle CCACGAAATCTGTAAAGAGAAATTTCCGACCAAAGATCCATGCCAG
Labrador_retriever CCACGAAATCTGTAAAGAGAAATTTCCGACCAAAGATCCATGCCAG
Swedish_wolf_21 CCACGAAATCTGTAAAGAGAAATTTCCGACCAAAGATCCATGCCAG
Bearded_collie CCACGAAATCTGTAAAGAGAAATTTCCGACCAAAGATCCATGCCAG
Snölandsströvare CCACGAAATCTGTAAAGAGAAATTTCCGACCAAAGATCCATGCCAG
Boxer        CCACGAAATCTGTAAAGAGAAATTTCCGACCAAAGATCCATGCCAG
Eurasian     CCACGAAATCTGTAAAGAGAAATTTCCGACCAAAGATCCATGCCAG
Swedish_wolf_34 CCACGAAATCTGTAAAGAGAAATTTCCGACCAAAGATCCATGCCAG
Genome_ref_seq_Boxer CCACGAAATCTGTAAAGAGAAATTTCCGACCAAAGATCCATGCCAG
Nova_Scotia_duck_tolling_retri CCACGAAATCTGTAAAGAGAAATTTCCGACCAAAGATCCATGCCAG
Dalmatian    CCACGAAATCTGTAAAGAGAAATTTCCGACCAAAGATCCATGCCAG
German_shepherd CCACGAAATCTGTAAAGAGAAATTTCCGACCAAAGATCCATGCCAG
Polish_lowland_sheepdog CCACGAAATCTGTAAAGAGAAATTTCCGACCAAAGATCCATGCCAG
Swedish_Elkhound CCACGAAATCTGTAAAGAGAAATTTCCGACCAAAGATCCATGCCAG
*****

Beagle      GTTGTGAGAAATCAGCAGCAGCAGCAATTTGATCCACAGCGCTGGAAT
Rottweiler  GTTGTGAGAAATCAGCAGCAGCAGCAATTTGATCCACAGCGCTGGAAT
Portuguese_water_dog GTTGTGAGAAATCAGCAGCAGCAGCAATTTGATCCACAGCGCTGGAAT
Rough_collie GTTGTGAGAAATCAGCAGCAGCAGCAATTTGATCCACAGCGCTGGAAT
Standard_poodle GTTGTGAGAAATCAGCAGCAGCAGCAATTTGATCCACAGCGCTGGAAT
Labrador_retriever GTTGTGAGAAATCAGCAGCAGCAGCAATTTGATCCACAGCGCTGGAAT
Swedish_wolf_21 GTTGTGAGAAATCAGCAGCAGCAGCAATTTGATCCACAGCGCTGGAAT
Bearded_collie GTTGTGAGAAATCAGCAGCAGCAGCAATTTGATCCACAGCGCTGGAAT
Snölandsströvare GTTGTGAGAAATCAGCAGCAGCAGCAATTTGATCCACAGCGCTGGAAT
Boxer        GTTGTGAGAAATCAGCAGCAGCAGCAATTTGATCCACAGCGCTGGAAT
Eurasian     GTTGTGAGAAATCAGCAGCAGCAGCAATTTGATCCACAGCGCTGGAAT
Swedish_wolf_34 GTTGTGAGAAATCAGCAGCAGCAGCAATTTGATCCACAGCGCTGGAAT

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Genome_ref_seq_Boxer	GTTGTCAGAAATCAGCAGCAGCAGCAATTCCTGATCCACAGCGCTGGAAT
Nova_Scotia_duck_tolling_retri	GTTGTCAGAAATCAGCAGCAGCAGCAATTCCTGATCCACAGCGCTGGAAT
Dalmatian	GTTGTCAGAAATCAGCAGCAGCAGCAATTCCTGATCCACAGCGCTGGAAT
German_shepherd	GTTGTCAGAAATCAGCAGCAGCAGCAATTCCTGATCCACAGCGCTGGAAT
Polish_lowland_sheepdog	GTTGTCAGAAATCAGCAGCAGCAGCAATTCCTGATCCACAGCGCTGGAAT
Swedish_Elkhound	GTTGTCAGAAATCAGCAGCAGCAGCAATTCCTGATCCACAGCGCTGGAAT

Beagle	GACAGAGCTAAAGGTCAAGAGGGCAAGAAAGGTTCAAACTTTTGCCTAA
Rottweiler	GACAGAGCTAAAGGTCAAGAGGGCAAGAAAGGTTCAAACTTTTGCCTAA
Portuguese_water_dog	GACAGAGCTAAAGGTCAAGAGGGCAAGAAAGGTTCAAACTTTTGCCTAA
Rough_collie	GACAGAGCTAAAGGTCAAGAGGGCAAGAAAGGTTCAAACTTTTGCCTAA
Standard_poodle	GACAGAGCTAAAGGTCAAGAGGGCAAGAAAGGTTCAAACTTTTGCCTAA
Labrador_retriever	GACAGAGCTAAAGGTCAAGAGGGCAAGAAAGGTTCAAACTTTTGCCTAA
Swedish_wolf_21	GACAGAGCTAAAGGTCAAGAGGGCAAGAAAGGTTCAAACTTTTGCCTAA
Bearded_collie	GACAGAGCTAAAGGTCAAGAGGGCAAGAAAGGTTCAAACTTTTGCCTAA
Snölandsströvare	GACAGAGCTAAAGGTCAAGAGGGCAAGAAAGGTTCAAACTTTTGCCTAA
Boxer	GACAGAGCTAAAGGTCAAGAGGGCAAGAAAGGTTCAAACTTTTGCCTAA
Eurasian	GACAGAGCTAAAGGTCAAGAGGGCAAGAAAGGTTCAAACTTTTGCCTAA
Swedish_wolf_34	GACAGAGCTAAAGGTCAAGAGGGCAAGAAAGGTTCAAACTTTTGCCTAA
Genome_ref_seq_Boxer	GACAGAGCTAAAGGTCAAGAGGGCAAGAAAGGTTCAAACTTTTGCCTAA
Nova_Scotia_duck_tolling_retri	GACAGAGCTAAAGGTCAAGAGGGCAAGAAAGGTTCAAACTTTTGCCTAA
Dalmatian	GACAGAGCTAAAGGTCAAGAGGGCAAGAAAGGTTCAAACTTTTGCCTAA
German_shepherd	GACAGAGCTAAAGGTCAAGAGGGCAAGAAAGGTTCAAACTTTTGCCTAA
Polish_lowland_sheepdog	GACAGAGCTAAAGGTCAAGAGGGCAAGAAAGGTTCAAACTTTTGCCTAA
Swedish_Elkhound	GACAGAGCTAAAGGTCAAGAGGGCAAGAAAGGTTCAAACTTTTGCCTAA

Beagle	AAGTATAAGGCAGAGAAGAAATTTCAAGGGCTTTTCCACCCCTGCAAAAG
Rottweiler	AAGTATAAGGCAGAGAAGAAATTTCAAGGGCTTTTCCACCCCTGCAAAAG
Portuguese_water_dog	AAGTATAAGGCAGAGAAGAAATTTCAAGGGCTTTTCCACCCCTGCAAAAG
Rough_collie	AAGTATAAGGCAGAGAAGAAATTTCAAGGGCTTTTCCACCCCTGCAAAAG
Standard_poodle	AAGTATAAGGCAGAGAAGAAATTTCAAGGGCTTTTCCACCCCTGCAAAAG
Labrador_retriever	AAGTATAAGGCAGAGAAGAAATTTCAAGGGCTTTTCCACCCCTGCAAAAG
Swedish_wolf_21	AAGTATAAGGCAGAGAAGAAATTTCAAGGGCTTTTCCACCCCTGCAAAAG
Bearded_collie	AAGTATAAGGCAGAGAAGAAATTTCAAGGGCTTTTCCACCCCTGCAAAAG
Snölandsströvare	AAGTATAAGGCAGAGAAGAAATTTCAAGGGCTTTTCCACCCCTGCAAAAG
Boxer	AAGTATAAGGCAGAGAAGAAATTTCAAGGGCTTTTCCACCCCTGCAAAAG
Eurasian	AAGTATAAGGCAGAGAAGAAATTTCAAGGGCTTTTCCACCCCTGCAAAAG
Swedish_wolf_34	AAGTATAAGGCAGAGAAGAAATTTCAAGGGCTTTTCCACCCCTGCAAAAG
Genome_ref_seq_Boxer	AAGTATAAGGCAGAGAAGAAATTTCAAGGGCTTTTCCACCCCTGCAAAAG
Nova_Scotia_duck_tolling_retri	AAGTATAAGGCAGAGAAGAAATTTCAAGGGCTTTTCCACCCCTGCAAAAG
Dalmatian	AAGTATAAGGCAGAGAAGAAATTTCAAGGGCTTTTCCACCCCTGCAAAAG
German_shepherd	AAGTATAAGGCAGAGAAGAAATTTCAAGGGCTTTTCCACCCCTGCAAAAG
Polish_lowland_sheepdog	AAGTATAAGGCAGAGAAGAAATTTCAAGGGCTTTTCCACCCCTGCAAAAG
Swedish_Elkhound	AAGTATAAGGCAGAGAAGAAATTTCAAGGGCTTTTCCACCCCTGCAAAAG

Beagle	GGCAAAACACGTGTGAGGGAAATAGTGAAGGAAGAGCCAGCGAGGCTCA
Rottweiler	GGCAAAACACGTGTGAGGGAAATAGTGAAGGAAGAGCCAGCGAGGCTCA
Portuguese_water_dog	GGCAAAACACGTGTGAGGGAAATAGTGAAGGAAGAGCCAGCGAGGCTCA
Rough_collie	GGCAAAACACGTGTGAGGGAAATAGTGAAGGAAGAGCCAGCGAGGCTCA
Standard_poodle	GGCAAAACACGTGTGAGGGAAATAGTGAAGGAAGAGCCAGCGAGGCTCA
Labrador_retriever	GGCAAAACACGTGTGAGGGAAATAGTGAAGGAAGAGCCAGCGAGGCTCA
Swedish_wolf_21	GGCAAAACACGTGTGAGGGAAATAGTGAAGGAAGAGCCAGCGAGGCTCA
Bearded_collie	GGCAAAACACGTGTGAGGGAAATAGTGAAGGAAGAGCCAGCGAGGCTCA
Snölandsströvare	GGCAAAACACGTGTGAGGGAAATAGTGAAGGAAGAGCCAGCGAGGCTCA
Boxer	GGCAAAACACGTGTGAGGGAAATAGTGAAGGAAGAGCCAGCGAGGCTCA
Eurasian	GGCAAAACACGTGTGAGGGAAATAGTGAAGGAAGAGCCAGCGAGGCTCA
Swedish_wolf_34	GGCAAAACACGTGTGAGGGAAATAGTGAAGGAAGAGCCAGCGAGGCTCA
Genome_ref_seq_Boxer	GGCAAAACACGTGTGAGGGAAATAGTGAAGGAAGAGCCAGCGAGGCTCA
Nova_Scotia_duck_tolling_retri	GGCAAAACACGTGTGAGGGAAATAGTGAAGGAAGAGCCAGCGAGGCTCA
Dalmatian	GGCAAAACACGTGTGAGGGAAATAGTGAAGGAAGAGCCAGCGAGGCTCA
German_shepherd	GGCAAAACACGTGTGAGGGAAATAGTGAAGGAAGAGCCAGCGAGGCTCA
Polish_lowland_sheepdog	GGCAAAACACGTGTGAGGGAAATAGTGAAGGAAGAGCCAGCGAGGCTCA
Swedish_Elkhound	GGCAAAACACGTGTGAGGGAAATAGTGAAGGAAGAGCCAGCGAGGCTCA

Beagle	CAGAAATTGAATCCAGAGGACACAGGCAAAATTATTCAGGGGGTAGGAAT
Rottweiler	CAGAAATTGAATCCAGAGGACACAGGCAAAATTATTCAGGGGGTAGGAAT
Portuguese_water_dog	CAGAAATTGAATCCAGAGGACACAGGCAAAATTATTCAGGGGGTAGGAAT
Rough_collie	CAGAAATTGAATCCAGAGGACACAGGCAAAATTATTCAGGGGGTAGGAAT
Standard_poodle	CAGAAATTGAATCCAGAGGACACAGGCAAAATTATTCAGGGGGTAGGAAT
Labrador_retriever	CAGAAATTGAATCCAGAGGACACAGGCAAAATTATTCAGGGGGTAGGAAT
Swedish_wolf_21	CAGAAATTGAATCCAGAGGACACAGGCAAAATTATTCAGGGGGTAGGAAT

Bearded_collie	CAGAAATTGAATCCAGAGGACACAGGCAAAATTATTCAAGGGGTAGGAAT
Snölandsströvar	CAGAAATTGAATCCAGAGGACACAGGCAAAATTATTCAAGGGGTAGGAAT
Boxer	CAGAAATTGAATCCAGAGGACACAGGCAAAATTATTCAAGGGGTAGGAAT
Eurasian	CAGAAATTGAATCCAGAGGACACAGGCAAAATTATTCAAGGGGTAGGAAT
Swedish_wolf_34	CAGAAATTGAATCCAGAGGACACAGGCAAAATTATTCAAGGGGTAGGAAT
Genome_ref_seq_Boxer	CAGAAATTGAATCCAGAGGACACAGGCAAAATTATTCAAGGGGTAGGAAT
Nova_Scotia_duck_tolling_retri	CAGAAATTGAATCCAGAGGACACAGGCAAAATTATTCAAGGGGTAGGAAT
Dalmatian	CAGAAATTGAATCCAGAGGACACAGGCAAAATTATTCAAGGGGTAGGAAT
German_shepherd	CAGAAATTGAATCCAGAGGACACAGGCAAAATTATTCAAGGGGTAGGAAT
Polish_lowland_sheepdog	CAGAAATTGAATCCAGAGGACACAGGCAAAATTATTCAAGGGGTAGGAAT
Swedish_Elkhound	CAGAAATTGAATCCAGAGGACACAGGCAAAATTATTCAAGGGGTAGGAAT
Beagle	GACAAGAATTATAAGAGTCAAAATATAGAGGCTGTGGGCGAGGCTTCAATG
Rottweiler	GACAAGAATTATAAGAGTCAAAATATAGAGGCTGTGGGCGAGGCTTCAATG
Portuguese_water_dog	GACAAGAATTATAAGAGTCAAAATATAGAGGCTGTGGGCGAGGCTTCAATG
Rough_collie	GACAAGAATTATAAGAGTCAAAATATAGAGGCTGTGGGCGAGGCTTCAATG
Standard_poodle	GACAAGAATTATAAGAGTCAAAATATAGAGGCTGTGGGCGAGGCTTCAATG
Labrador_retriever	GACAAGAATTATAAGAGTCAAAATATAGAGGCTGTGGGCGAGGCTTCAATG
Swedish_wolf_21	GACAAGAATTATAAGAGTCAAAATATAGAGGCTGTGGGCGAGGCTTCAATG
Bearded_collie	GACAAGAATTATAAGAGTCAAAATATAGAGGCTGTGGGCGAGGCTTCAATG
Snölandsströvar	GACAAGAATTATAAGAGTCAAAATATAGAGGCTGTGGGCGAGGCTTCAATG
Boxer	GACAAGAATTATAAGAGTCAAAATATAGAGGCTGTGGGCGAGGCTTCAATG
Eurasian	GACAAGAATTATAAGAGTCAAAATATAGAGGCTGTGGGCGAGGCTTCAATG
Swedish_wolf_34	GACAAGAATTATAAGAGTCAAAATATAGAGGCTGTGGGCGAGGCTTCAATG
Genome_ref_seq_Boxer	GACAAGAATTATAAGAGTCAAAATATAGAGGCTGTGGGCGAGGCTTCAATG
Nova_Scotia_duck_tolling_retri	GACAAGAATTATAAGAGTCAAAATATAGAGGCTGTGGGCGAGGCTTCAATG
Dalmatian	GACAAGAATTATAAGAGTCAAAATATAGAGGCTGTGGGCGAGGCTTCAATG
German_shepherd	GACAAGAATTATAAGAGTCAAAATATAGAGGCTGTGGGCGAGGCTTCAATG
Polish_lowland_sheepdog	GACAAGAATTATAAGAGTCAAAATATAGAGGCTGTGGGCGAGGCTTCAATG
Swedish_Elkhound	GACAAGAATTATAAGAGTCAAAATATAGAGGCTGTGGGCGAGGCTTCAATG
Beagle	ATAGGTCACATCTCAGCAGACATCAGAGGACACACACGGGAGAGAACCT
Rottweiler	ATAGGTCACATCTCAGCAGACATCAGAGGACACACACGGGAGAGAACCT
Portuguese_water_dog	ATAGGTCACATCTCAGCAGACATCAGAGGACACACACGGGAGAGAACCT
Rough_collie	ATAGGTCACATCTCAGCAGACATCAGAGGACACACACGGGAGAGAACCT
Standard_poodle	ATAGGTCACATCTCAGCAGACATCAGAGGACACACACGGGAGAGAACCT
Labrador_retriever	ATAGGTCACATCTCAGCAGACATCAGAGGACACACACGGGAGAGAACCT
Swedish_wolf_21	ATAGGTCACATCTCAGCAGACATCAGAGGACACACACGGGAGAGAACCT
Bearded_collie	ATAGGTCACATCTCAGCAGACATCAGAGGACACACACGGGAGAGAACCT
Snölandsströvar	ATAGGTCACATCTCAGCAGACATCAGAGGACACACACGGGAGAGAACCT
Boxer	ATAGGTCACATCTCAGCAGACATCAGAGGACACACACGGGAGAGAACCT
Eurasian	ATAGGTCACATCTCAGCAGACATCAGAGGACACACACGGGAGAGAACCT
Swedish_wolf_34	ATAGGTCACATCTCAGCAGACATCAGAGGACACACACGGGAGAGAACCT
Genome_ref_seq_Boxer	ATAGGTCACATCTCAGCAGACATCAGAGGACACACACGGGAGAGAACCT
Nova_Scotia_duck_tolling_retri	ATAGGTCACATCTCAGCAGACATCAGAGGACACACACGGGAGAGAACCT
Dalmatian	ATAGGTCACATCTCAGCAGACATCAGAGGACACACACGGGAGAGAACCT
German_shepherd	ATAGGTCACATCTCAGCAGACATCAGAGGACACACACGGGAGAGAACCT
Polish_lowland_sheepdog	ATAGGTCACATCTCAGCAGACATCAGAGGACACACACGGGAGAGAACCT
Swedish_Elkhound	ATAGGTCACATCTCAGCAGACATCAGAGGACACACACGGGAGAGAACCT
Beagle	TATGTTTGCAGGGAGTGTGGGCGAGGCTTTATACACAGAACAAATCTTAT
Rottweiler	TATGTTTGCAGGGAGTGTGGGCGAGGCTTTATACACAGAACAAATCTTAT
Portuguese_water_dog	TATGTTTGCAGGGAGTGTGGGCGAGGCTTTATACACAGAACAAATCTTAT
Rough_collie	TATGTTTGCAGGGAGTGTGGGCGAGGCTTTATACACAGAACAAATCTTAT
Standard_poodle	TATGTTTGCAGGGAGTGTGGGCGAGGCTTTATACACAGAACAAATCTTAT
Labrador_retriever	TATGTTTGCAGGGAGTGTGGGCGAGGCTTTATACACAGAACAAATCTTAT
Swedish_wolf_21	TATGTTTGCAGGGAGTGTGGGCGAGGCTTTATACACAGAACAAATCTTAT
Bearded_collie	TATGTTTGCAGGGAGTGTGGGCGAGGCTTTATACACAGAACAAATCTTAT
Snölandsströvar	TATGTTTGCAGGGAGTGTGGGCGAGGCTTTATACACAGAACAAATCTTAT
Boxer	TATGTTTGCAGGGAGTGTGGGCGAGGCTTTATACACAGAACAAATCTTAT
Eurasian	TATGTTTGCAGGGAGTGTGGGCGAGGCTTTATACACAGAACAAATCTTAT
Swedish_wolf_34	TATGTTTGCAGGGAGTGTGGGCGAGGCTTTATACACAGAACAAATCTTAT
Genome_ref_seq_Boxer	TATGTTTGCAGGGAGTGTGGGCGAGGCTTTATACACAGAACAAATCTTAT
Nova_Scotia_duck_tolling_retri	TATGTTTGCAGGGAGTGTGGGCGAGGCTTTATACACAGAACAAATCTTAT
Dalmatian	TATGTTTGCAGGGAGTGTGGGCGAGGCTTTATACACAGAACAAATCTTAT
German_shepherd	TATGTTTGCAGGGAGTGTGGGCGAGGCTTTATACACAGAACAAATCTTAT
Polish_lowland_sheepdog	TATGTTTGCAGGGAGTGTGGGCGAGGCTTTATACACAGAACAAATCTTAT
Swedish_Elkhound	TATGTTTGCAGGGAGTGTGGGCGAGGCTTTATACACAGAACAAATCTTAT
Beagle	CATACATCAGAGAACACACACAGGGAGAGCCCTACGTTTGCAGGGAAT
Rottweiler	CATACATCAGAGAACACACACAGGGAGAGCCCTACGTTTGCAGGGAAT

Portuguese_water_dog	CATACATCAGAGAACACACAGGGGAGAGCCCTACGTTTGCAGGGAAT
Rough_collie	CATACATCAGAGAACACACAGGGGAGAGCCCTACGTTTGCAGGGAAT
Standard_poodle	CATACATCAGAGAACACACAGGGGAGAGCCCTACGTTTGCAGGGAAT
Labrador_retriever	CATACATCAGAGAACACACAGGGGAGAGCCCTACGTTTGCAGGGAAT
Swedish_wolf_21	CATACATCAGAGAACACACAGGGGAGAGCCCTACGTTTGCAGGGAAT
Bearded_collie	CATACATCAGAGAACACACAGGGGAGAGCCCTACGTTTGCAGGGAAT
Snällsströvare	CATACATCAGAGAACACACAGGGGAGAGCCCTACGTTTGCAGGGAAT
Boxer	CATACATCAGAGAACACACAGGGGAGAGCCCTACGTTTGCAGGGAAT
Eurasian	CATACATCAGAGAACACACAGGGGAGAGCCCTACGTTTGCAGGGAAT
Swedish_wolf_34	CATACATCAGAGAACACACAGGGGAGAGCCCTACGTTTGCAGGGAAT
Genome_ref_seq_Boxer	CATACATCAGAGAACACACAGGGGAGAGCCCTACGTTTGCAGGGAAT
Nova_Scotia_duck_tolling_retri	CATACATCAGAGAACACACAGGGGAGAGCCCTACGTTTGCAGGGAAT
Dalmatian	CATACATCAGAGAACACACAGGGGAGAGCCCTACGTTTGCAGGGAAT
German_shepherd	CATACATCAGAGAACACACAGGGGAGAGCCCTACGTTTGCAGGGAAT
Polish_lowland_sheepdog	CATACATCAGAGAACACACAGGGGAGAGCCCTACGTTTGCAGGGAAT
Swedish_Elkhound	CATACATCAGAGAACACACAGGGGAGAGCCCTACGTTTGCAGGGAAT

Beagle	GTGGACAGGCTTTATACAGAGGTCAATCTCAGCATACATCAGAGGACAC
Rottweiler	GTGGACAGGCTTTATACAGAGGTCAATCTCAGCATACATCAGAGGACAC
Portuguese_water_dog	GTGGACAGGCTTTATACAGAGGTCAATCTCAGCATACATCAGAGGACAC
Rough_collie	GTGGACAGGCTTTATACAGAGGTCAATCTCAGCATACATCAGAGGACAC
Standard_poodle	GTGGACAGGCTTTATACAGAGGTCAATCTCAGCATACATCAGAGGACAC
Labrador_retriever	GTGGACAGGCTTTATACAGAGGTCAATCTCAGCATACATCAGAGGACAC
Swedish_wolf_21	GTGGACAGGCTTTATACAGAGGTCAATCTCAGCATACATCAGAGGACAC
Bearded_collie	GTGGACAGGCTTTATACAGAGGTCAATCTCAGCATACATCAGAGGACAC
Snällsströvare	GTGGACAGGCTTTATACAGAGGTCAATCTCAGCATACATCAGAGGACAC
Boxer	GTGGACAGGCTTTATACAGAGGTCAATCTCAGCATACATCAGAGGACAC
Eurasian	GTGGACAGGCTTTATACAGAGGTCAATCTCAGCATACATCAGAGGACAC
Swedish_wolf_34	GTGGACAGGCTTTATACAGAGGTCAATCTCAGCATACATCAGAGGACAC
Genome_ref_seq_Boxer	GTGGACAGGCTTTATACAGAGGTCAATCTCAGCATACATCAGAGGACAC
Nova_Scotia_duck_tolling_retri	GTGGACAGGCTTTATACAGAGGTCAATCTCAGCATACATCAGAGGACAC
Dalmatian	GTGGACAGGCTTTATACAGAGGTCAATCTCAGCATACATCAGAGGACAC
German_shepherd	GTGGACAGGCTTTATACAGAGGTCAATCTCAGCATACATCAGAGGACAC
Polish_lowland_sheepdog	GTGGACAGGCTTTATACAGAGGTCAATCTCAGCATACATCAGAGGACAC
Swedish_Elkhound	GTGGACAGGCTTTATACAGAGGTCAATCTCAGCATACATCAGAGGACAC

Beagle	ACACAGGGGAGAGCCCTATGTTTGCAGGGAATGTGGGAGGCTTTACA
Rottweiler	ACACAGGGGAGAGCCCTATGTTTGCAGGGAATGTGGGAGGCTTTACA
Portuguese_water_dog	ACACAGGGGAGAGCCCTATGTTTGCAGGGAATGTGGGAGGCTTTACA
Rough_collie	ACACAGGGGAGAGCCCTATGTTTGCAGGGAATGTGGGAGGCTTTACA
Standard_poodle	ACACAGGGGAGAGCCCTATGTTTGCAGGGAATGTGGGAGGCTTTACA
Labrador_retriever	ACACAGGGGAGAGCCCTATGTTTGCAGGGAATGTGGGAGGCTTTACA
Swedish_wolf_21	ACACAGGGGAGAGCCCTATGTTTGCAGGGAATGTGGGAGGCTTTACA
Bearded_collie	ACACAGGGGAGAGCCCTATGTTTGCAGGGAATGTGGGAGGCTTTACA
Snällsströvare	ACACAGGGGAGAGCCCTATGTTTGCAGGGAATGTGGGAGGCTTTACA
Boxer	ACACAGGGGAGAGCCCTATGTTTGCAGGGAATGTGGGAGGCTTTACA
Eurasian	ACACAGGGGAGAGCCCTATGTTTGCAGGGAATGTGGGAGGCTTTACA
Swedish_wolf_34	ACACAGGGGAGAGCCCTATGTTTGCAGGGAATGTGGGAGGCTTTACA
Genome_ref_seq_Boxer	ACACAGGGGAGAGCCCTATGTTTGCAGGGAATGTGGGAGGCTTTACA
Nova_Scotia_duck_tolling_retri	ACACAGGGGAGAGCCCTATGTTTGCAGGGAATGTGGGAGGCTTTACA
Dalmatian	ACACAGGGGAGAGCCCTATGTTTGCAGGGAATGTGGGAGGCTTTACA
German_shepherd	ACACAGGGGAGAGCCCTATGTTTGCAGGGAATGTGGGAGGCTTTACA
Polish_lowland_sheepdog	ACACAGGGGAGAGCCCTATGTTTGCAGGGAATGTGGGAGGCTTTACA
Swedish_Elkhound	ACACAGGGGAGAGCCCTATGTTTGCAGGGAATGTGGGAGGCTTTACA

Beagle	CAGAGGTCAACTCTCAACGAACACAGAGGACACACAGGAGGAGAGCC
Rottweiler	CAGAGGTCAACTCTCAACGAACACAGAGGACACACAGGAGGAGAGCC
Portuguese_water_dog	CAGAGGTCAACTCTCAACGAACACAGAGGACACACAGGAGGAGAGCC
Rough_collie	CAGAGGTCAACTCTCAACGAACACAGAGGACACACAGGAGGAGAGCC
Standard_poodle	CAGAGGTCAACTCTCAACGAACACAGAGGACACACAGGAGGAGAGCC
Labrador_retriever	CAGAGGTCAACTCTCAACGAACACAGAGGACACACAGGAGGAGAGCC
Swedish_wolf_21	CAGAGGTCAACTCTCAACGAACACAGAGGACACACAGGAGGAGAGCC
Bearded_collie	CAGAGGTCAACTCTCAACGAACACAGAGGACACACAGGAGGAGAGCC
Snällsströvare	CAGAGGTCAACTCTCAACGAACACAGAGGACACACAGGAGGAGAGCC
Boxer	CAGAGGTCAACTCTCAACGAACACAGAGGACACACAGGAGGAGAGCC
Eurasian	CAGAGGTCAACTCTCAACGAACACAGAGGACACACAGGAGGAGAGCC
Swedish_wolf_34	CAGAGGTCAACTCTCAACGAACACAGAGGACACACAGGAGGAGAGCC
Genome_ref_seq_Boxer	CAGAGGTCAACTCTCAACGAACACAGAGGACACACAGGAGGAGAGCC
Nova_Scotia_duck_tolling_retri	CAGAGGTCAACTCTCAACGAACACAGAGGACACACAGGAGGAGAGCC
Dalmatian	CAGAGGTCAACTCTCAACGAACACAGAGGACACACAGGAGGAGAGCC
German_shepherd	CAGAGGTCAACTCTCAACGAACACAGAGGACACACAGGAGGAGAGCC
Polish_lowland_sheepdog	CAGAGGTCAACTCTCAACGAACACAGAGGACACACAGGAGGAGAGCC

Swedish_Elkhound	CAGAGGTCAACTCTCAACGAACACAGAGGACACACGGAGGAGAAGCC *****
Beagle	CTATGTTTGCAGGGAGTGTGGGCGAAGCTTTACACGGAGGTCAACTCTCA
Rottweiler	CTATGTTTGCAGGGAGTGTGGGCGAAGCTTTACACGGAGGTCAACTCTCA
Portuguese_water_dog	CTATGTTTGCAGGGAGTGTGGGCGAAGCTTTACACGGAGGTCAACTCTCA
Rough_collie	CTATGTTTGCAGGGAGTGTGGGCGAAGCTTTACACGGAGGTCAACTCTCA
Standard_poodle	CTATGTTTGCAGGGAGTGTGGGCGAAGCTTTACACGGAGGTCAACTCTCA
Labrador_retriever	CTATGTTTGCAGGGAGTGTGGGCGAAGCTTTACACGGAGGTCAACTCTCA
Swedish_wolf_21	CTATGTTTGCAGGGAGTGTGGGCGAAGCTTTACACGGAGGTCAACTCTCA
Bearded_collie	CTATGTTTGCAGGGAGTGTGGGCGAAGCTTTACACGGAGGTCAACTCTCA
Snällsströvare	CTATGTTTGCAGGGAGTGTGGGCGAAGCTTTACACGGAGGTCAACTCTCA
Boxer	CTATGTTTGCAGGGAGTGTGGGCGAAGCTTTACACGGAGGTCAACTCTCA
Eurasian	CTATGTTTGCAGGGAGTGTGGGCGAAGCTTTACACGGAGGTCAACTCTCA
Swedish_wolf_34	CTATGTTTGCAGGGAGTGTGGGCGAAGCTTTACACGGAGGTCAACTCTCA
Genome_ref_seq_Boxer	CTATGTTTGCAGGGAGTGTGGGCGAAGCTTTACACGGAGGTCAACTCTCA
Nova_Scotia_duck_tolling_retri	CTATGTTTGCAGGGAGTGTGGGCGAAGCTTTACACGGAGGTCAACTCTCA
Dalmatian	CTATGTTTGCAGGGAGTGTGGGCGAAGCTTTACACGGAGGTCAACTCTCA
German_shepherd	CTATGTTTGCAGGGAGTGTGGGCGAAGCTTTACACGGAGGTCAACTCTCA
Polish_lowland_sheepdog	CTATGTTTGCAGGGAGTGTGGGCGAAGCTTTACACGGAGGTCAACTCTCA
Swedish_Elkhound	CTATGTTTGCAGGGAGTGTGGGCGAAGCTTTACACGGAGGTCAACTCTCA *****
Beagle	TCACACACAGAGGACACACACAGGGGAGAGGCCCTATGTTTGCAGGGAG
Rottweiler	TCACACACAGAGGACACACACAGGGGAGAGGCCCTATGTTTGCAGGGAG
Portuguese_water_dog	TCACACACAGAGGACACACACAGGGGAGAGGCCCTATGTTTGCAGGGAG
Rough_collie	TCACACACAGAGGACACACACAGGGGAGAGGCCCTATGTTTGCAGGGAG
Standard_poodle	TCACACACAGAGGACACACACAGGGGAGAGGCCCTATGTTTGCAGGGAG
Labrador_retriever	TCACACACAGAGGACACACACAGGGGAGAGGCCCTATGTTTGCAGGGAG
Swedish_wolf_21	TCACACACAGAGGACACACACAGGGGAGAGGCCCTATGTTTGCAGGGAG
Bearded_collie	TCACACACAGAGGACACACACAGGGGAGAGGCCCTATGTTTGCAGGGAG
Snällsströvare	TCACACACAGAGGACACACACAGGGGAGAGGCCCTATGTTTGCAGGGAG
Boxer	TCACACACAGAGGACACACACAGGGGAGAGGCCCTATGTTTGCAGGGAG
Eurasian	TCACACACAGAGGACACACACAGGGGAGAGGCCCTATGTTTGCAGGGAG
Swedish_wolf_34	TCACACACAGAGGACACACACAGGGGAGAGGCCCTATGTTTGCAGGGAG
Genome_ref_seq_Boxer	TCACACACAGAGGACACACACAGGGGAGAGGCCCTATGTTTGCAGGGAG
Nova_Scotia_duck_tolling_retri	TCACACACAGAGGACACACACAGGGGAGAGGCCCTATGTTTGCAGGGAG
Dalmatian	TCACACACAGAGGACACACACAGGGGAGAGGCCCTATGTTTGCAGGGAG
German_shepherd	TCACACACAGAGGACACACACAGGGGAGAGGCCCTATGTTTGCAGGGAG
Polish_lowland_sheepdog	TCACACACAGAGGACACACACAGGGGAGAGGCCCTATGTTTGCAGGGAG
Swedish_Elkhound	TCACACACAGAGGACACACACAGGGGAGAGGCCCTATGTTTGCAGGGAG *****
Beagle	TGTGGGC-----GAAGCTTTACAAAGAGGTCA
Rottweiler	TGTGGGC-----GAAGCTTTACAAAGAGGTCA
Portuguese_water_dog	TGTGGGC-----GAAGCTTTACAAAGAGGTCA
Rough_collie	TGTGGGC-----GAAGCTTTACAAAGAGGTCA
Standard_poodle	TGTGGGC-----GAAGCTTTACAAAGAGGTCA
Labrador_retriever	TGTGGGC-----GAAGCTTTACAAAGAGGTCA
Swedish_wolf_21	TGTGGGC-----GAAGCTTTACAAAGAGGTCA
Bearded_collie	TGTGGGC-----GAAGCTTTACAAAGAGGTCA
Snällsströvare	TGTGGGC-----GAAGCTTTACAAAGAGGTCA
Boxer	TGTGGGC-----GAAGCTTTACAAAGAGGTCA
Eurasian	TGTGGGC-----GAAGCTTTACAAAGAGGTCA
Swedish_wolf_34	TGTGGGC-----GAAGCTTTACAAAGAGGTCA
Genome_ref_seq_Boxer	TGTGGGC-----GAAGCTTTACAAAGAGGTCA
Nova_Scotia_duck_tolling_retri	TGTGGGC-----GAAGCTTTACAAAGAGGTCA
Dalmatian	TGTGGGC-----GAAGCTTTACAAAGAGGTCA
German_shepherd	TGTGGGC-----GAAGCTTTACAAAGAGGTCA
Polish_lowland_sheepdog	TGTGGGC-----GAAGCTTTACAAAGAGGTCA
Swedish_Elkhound	TGTGGGC-----GAAGCTTTACAAAGAGGTCA *****

Supplemental Figure 3.

Human and Panda alignment

PRDM9_HUMAN	1	MSPEKSQEE SPEEDTERTERKPMVK MS S EE+PE D+ RT KP V+ MSLNTSPEETPERDSGRTGWKPTVR	
ailMel1_dna	3085	aacaatcggacgagtgaagtacagaGGTGTGGG tgtaccaaccagacggcggacctg gcccgcagggtagcggaagggcgga	D:D[gat] Intron 1 <1-----[3161 : 3572]
PRDM9_HUMAN	26	AFKDISIYFTKEEWAEMGDWEKTRYRNVKRNYNALITI AFKDISIYF+KEEW EMGDWEK RYRNVKRNY ALITI AFKDISIYFSKEEWTEMGDWEKIRYRNVKRNYEALITI	
ailMel1_dna	3570	AAGATgtagatatattaggtagaggtgaactaagaaatggcaaa -1> ctaatctatcaaagcatgagaatgagatagaaacttct tcactcaccggaagaggacggacacgtgagccaagtta	
PRDM9_HUMAN	65		LRATRPAFMCHRRQAIKLQVDDT LRA RPAFMCHRRQAIK QVDDT LRAPRPAFMCHRRQAIKPQVDDT
ailMel1_dna	3689	GGTAATGA Intron 2 TAGGTcagcccgatccacgaaccggga <1-----[3690 : 4008]-1> tgccgccttgaggactacataac cactcatcgtcgggccacaatct	G:G[ggt]
PRDM9_HUMAN	89	EDSDEEWTPRQQ EDSDEEWTPR+Q EDSDEEWTPRRQ	KPPWMALRVEQ +P W+A R+EQ RPSWVAFRMEQ
ailMel1_dna	4080	ggtgggtacaccGGTGAGGG Intron 3 TAGTCacttggtgaagc aacaaagccgga <1-----[4117 : 10995]-1> gccgtctgtaa gtttaaggggga attggacaggg	V:V[gtc]
PRDM9_HUMAN	113	RKHQK KHQ+ SKHQR	GMPKASFSNESSLKELSR TAN G+P+A + NESSLKELS TA GIPRAPLRNESSLKELSETAK
ailMel1_dna	11031	aaccaGTGAGTA Intron 4 AAGgacagctcagtatagttgaga gaaag<0-----[11046:12777]-0>gtcgcctgaacgtaacacca tacgg aacggaatcagtggaataaaag	
PRDM9_HUMAN	139	LLNASGSEQAQKPVSPSGEASTSGQHSRLKL LLN SGSE QKPVS GEASTSG S KL LLNTSGSELGQKPVSLPGEASTSGHDSLQKL	
ailMel1_dna	12841	tcaaagtgcgcacgtccgggaatgcgtccat ttacggcatgaactctcgacgccgaactaat ggcatcagtcgaagcttaaatctatccaaag	
PRDM9_HUMAN	170		LRKKETERKMYSLRERKGHAYKE R+K+ E KMYSLRERK AY+E FRRKDVEVKMYSLRERKSLAYQE
ailMel1_dna	12934	GGTAAGAA Intron 5 CAGGAtaaaggggaataaccgaaacgtcg <1-----[12935:13568]-1> tggaatatatagtgagagtcaaa cgagttaaggtcaaaagctacag	E:G[gga]

PRDM9_HUMAN	194	VSEPQDDDDL VSEPQDDDDL VSEPQDDDDL		CEMCQNFFIDSCA CE CQNFFIDSCA CEKCQNFFIDSCA
ailMel1_dna	13640	gagccgggtcTGTAAGTG	Y:Y[tat] Intron 6	CAGATtgatcattagatg tgacaaaaat <1-----[13671:13885]-1> gaagaatttaggc ccgcgttccc
PRDM9_HUMAN	218	AHGPPTFVKDSAVDKGHPNRSALSLPPGLRIGPSGIPQAGLGVWNEASD HGPPTFVKDSAVDKG PNRSA+LPPGLRI PSGIPQAGLGVWNEASD VHGPPTFVKDSAVDKGQPNRSALTLPGLRIRPSGIPQAGLGVWNEASD		
ailMel1_dna	13927	gcgcatgagagggagccactgcacccgcaaactgaccggcggttaggtg tagcccttaagctaagacagcctctccgtgtgccgtcacgtgtgaacca ttgccatagctagcggaccacactgcttgacaaacccgtgtaagcgatt		
PRDM9_HUMAN	267	LPLGLHFGPYEGRITEDEEAANNYSWL LPLGLHFGPYEG+ITEDEEAAN+GYSWL LPLGLHFGPYEQITEDEEAANSYSWL		
ailMel1_dna	14074	cctgcctgctggcaaggggggaagttttGTGAGAA	Intron 7	tctgtatgaagatcaaaaccaggacgt<0-----[14158:14585] aagtacttctgcacaatagaccacccg
PRDM9_HUMAN	295	ITKGRNCYEYVDGKDKSWANWM ITKGRNCYEYVDGKD SWANWM ITKGRNCYEYVDGKDNSWANWM		R:R[agg]
ailMel1_dna	14583	CAGaaagaattgtgggagattgataAGGTAAGAC	Intron 8	-0>tcaggagaaatagaaacgcagt <2-----[14654:15806] ccagacctgtgtagtctgcgg
PRDM9_HUMAN	317	YVNCARDDEEQNLVAFQYHRQIFYRTCRVIRPGCELLVWYGDEYG YVNCARD+EEQNLVAFQYHRQIFYRTCRVIRPGCELLVWYGDEYG YVNCARDEEEQNLVAFQYHRQIFYRTCRVIRPGCELLVWYGDEYG		
ailMel1_dna	15804	TAGGtgatgaggggacgggtctcacattcatcgaacgtgccgttggtg -2> atagcgaaaaaatctaaagattagcggttgcggtttgagaaag cgctcgtggggcggtaccggcccagcgccgactaggcggtgcgc		
PRDM9_HUMAN	363	QELGIKWGSKWKELMAGR QELGIKWGSKWK EL AG+ QELGIKWGSKWKSELAAGK		EPKP EPKP EPKP
ailMel1_dna	15943	cgcgaaatgaataagcgggaGGTGGGCA	Intron 9	CAGGAGcac aatgtagggagagatccga <1-----[16001:17737]-1> acac gggccagacgggcgcgaga aaga
PRDM9_HUMAN	386	EIHPCPSCCLAFSSQKFLSQHVERNHSQNFPGPSARKLLQPENPCPGD EIHPCPSC LAFSSQKFLSQH+E NH SQ + SA + Q E+PCPG EIHPCPSCSLAFSSQKFLSQHLEHNHPSQILSRKSASEHFQQEDPCPGH		
ailMel1_dna	17752	gacctctttcggtacatcacctgcacctcactcatgagctccggctcgc atacgccgctctcgaattgaataaaacattcgaccgaataaaacgcga gctattcctgcccctgaccatgactcttgccaaatacatcaagtccact		
PRDM9_HUMAN	435	QNQEQQ-YDPHPSRNDKTKGQEIERSKLLNKRTWQREISRAFSSPPKG QNQ+QQ DPH NDK KGQE+KER K L K QR ISRAFSSP KG QNQQQQHSDPHRWNDKAKGQEVKERFKPLLKSIRQRISRAFSSPCKG		
ailMel1_dna	17899	cacccccctgccatagagagcggagataactcaaaacaaatagttactag aaaaaaaaacaggaacagaataagtacttagtgaggctcgctcgcgag		

gtggggatttttcggtcatatagcaagcatgtatagggatagctctacaa

PRDM9_HUMAN	483	QMGSCRVGKRIMEEESRTGQKVNPGNTGKLFVGVGISRIAKVKYGECCGQ Q S V + ++EEE GQK+NP TGKLF+GVG+S I +VKY CG+ QTRSSTVCEGMVEEESAGQKLNPEETGKLFMGVGMSTGIIRVKYRGCGR
ailMel1_dna	18046	caaatagtggaggggcaggcatacggagattagggatgaaagatagtc acggcctgagttaaacgcgaatacaacgatttgtgtcggttgtaaggggg aggctagtgagggagctacgagtaggaaaacggaagaataacatactga
PRDM9_HUMAN	532	GFSVKSDVITHQRTHTGEKLYVCRECGRGFSWKSHLLIHQRIHTGEKPY FS +S HQR H K VC++ R FS KS L+ HQR HTGEKPY DFSDRSHQSGHQRRHQ-KKPSVCKKVKREFSHKSVLITHQRTHTGEKPY
ailMel1_dna	18193	gtagatccagccaacc aactgtaagaagtacatgaaccaacaggact atgagcaaggaaggaa aacctgaatagatgaactttcaagcacgaaca ccttgatacacgaaca agctgcggggagcttgactaacggacagggcc
PRDM9_HUMAN	581	VCRECGRGFSWQSVLLTHQRTHTGEKPYVCRECGRGFSRQSVLLTHQRR VCRECGRGF+ +S L+ HQRHTHTGEKPYVCRECGRGF+++S L+ HQR VCRECGRGFTQRSNLIRHQRHTHTGEKPYVCRECGRGFTQRSNLIRHQR
ailMel1_dna	18337	gtagtgcggtacatacaaccaacaggactgtagtgcggtacatacaaccaa tgaggggggtcagcattgaagcacgaacatggaggggtcagcattgaagc tcggtggctgggatccacggacagggcctcggtggctgggatccacgga
PRDM9_HUMAN	630	HTGEKPYVCRECGRGFSRQSVLLTHQRRHTGEKPYVCRECGRGFSWQSV HTGEKPYVCRECGRGF+++S L+ HQR HTGEKPYVCRECGRGF+ + HTGEKPYVCRECGRGFTQRSSLIRHQRHTHTGEKPYVCRECGRGFTLRPN
ailMel1_dna	18484	caggactgtagtgcggtacatacaaccaacaggactgtagtgcggtacaca acgaacatggaggggtcagcggttgaagcacgaacatggaggggtctgca cagggcctcggtggctaggatccacggacagggcctcggtgactaggat
PRDM9_HUMAN	679	LLTHQRTHT L+ HQRHTHT LIGHQRTHT
ailMel1_dna	18631	cagccaaca ttgaagcac ccacggaca

Supplemental Figure 4.

Human and Cat alignment

PRDM9_HUMAN	101	VKPPWMALRVEQRKHQK		GMPKASFSN
		VKP W+A RV+Q K K		G + +S
		VKPSWVASRVDQNKQHK		GTHRVPLSK
felCat3_dna	274	gacttggtaggcaaccaGTGAGTA	Intron 1	AAGgacagctaa
		taccgtccgtaaaaaaa<0-----[325 : 3018]-0>		gcagtctga
		cattggacagtgtaacg		accagaatg
PRDM9_HUMAN	127	ESSLKELSR TANLLNASGSEQAQKPVSPSGEASTSGQHSRLKL		
		ESSLK+ S TA LLN SGSEQ QKPVS GEASTSG HSR KL		
		ESSLKDFSETAKLLNTSGSEQGQKPVSLPGEASTSGHHSRRKL		
felCat3_dna	3046	gtatagttgagatcaaagtgcgcacgtccgggaatgcctacat		
		acgtaatcaccattacggcaagaactctcgacgccgaacggat		
		attggccaaaagggcatcaggcgaagcttaaatctatctaaag		
PRDM9_HUMAN	170			LRKKETERKMYSLRERKGHAYKE
				LR+KE KMYSLRERKG AY+E
		E:E[gag]		LRRKEIGVKMYSLRERKGFAYQE
felCat3_dna	3175	GGTAAGAG	Intron 2	CAGAGcaaagaggaataaccgaagtgtcg
		<1-----[3176 : 3810]-1>		tggaatgtatagtgtgagagtc
				cgaggtagggttaaaagctgcag
PRDM9_HUMAN	194	VSEPQDDDDL		CEMCQNFFIDSCA
		VSEPQDDDDL		CE CQNFFIDSCA
		VSEPQDDDDL	Y:Y[tat]	CEKCQNFFIDSCA
felCat3_dna	3882	gagccgggtcTGTAAGTG	Intron 3	CAGATtgatcattagatg
		tgacaaaaat <1-----[3913 : 4126]-1>		gaagaatttaggc
		ccgcgttccc		tggtgtcctctct
PRDM9_HUMAN	218	AHGPPTFVKDSAVDKGHPNRSALSLPPGLRIGPSGIPQAGLGVWNEASD		
		HGPPTFVKD+AV KGHPNRSAL+LPPGLRI PS IP+AGLGVWNEASD		
		VHGPPTFVKDNAVKGHPNRSALTLPGLRIRPSSIPEAGLGVWNEASD		
felCat3_dna	4168	gcgccatgagagggagccactgcacccgcaaactaacggcggttaggtg		
		tagcccttaactgagacagcctctccgtgtgccgtcacgtgtgaacca		
		ttactacagctagcgggtcccacctgcttgacaagcctgtgtaagtaatt		
PRDM9_HUMAN	267	LPLGLHFGPYEGRITEDEEAANNNGYSWL		
		LPLG HFGPYEG+ITEDEEAAN+GYSWL		
		LPLGTHFGPYEQITEDEEAANSNGYSWL		
felCat3_dna	4315	cccgactgctggcaaggggggaagtttcGTGAGAA	Intron 4	
		tctgcatgcaagatcaaaaccaggacgt<0-----[4399 : 4817]		
		gagtactcctgcgccacagacctaccgg		
PRDM9_HUMAN	295	ITKGRNCYEYVDGDKSWANWM		
		ITKGRNCYEYVDGKD SWANWM		
		ITKGRNCYEYVDGKDNSWANWM		R:R[agg]
felCat3_dna	4815	CAGaaagaattgtgggagattgataAGGTAAGGC	Intron 5	
		-0>tcaggagaaatagaaacgcagt <2-----[4886 : 5506]		
		ccagacccgtgtagtctgccgg		

PRDM9_HUMAN	317	YVNCARDDEEQNLVAFQYHRQIFYRTCRVIRPGCELLVWYGDEYG YVNCARDDEEQNLVAFQYHRQIFYRTCRVIRPGCELLVWYGDEYG YVNCARDDEEQNLVAFQYHRQIFYRTCRVIRPGCELLVWYGDEYG	
felCat3_dna	5504	CAGGtgatgaggggcacggtctcacattcatcgaacgtgccgttgggtg -2> atagcgaataattctaaagattagcggttgcggatttgagaaag tgctcgctgggcggctgtcggcccaccgccgactagacgtgcgcc	
PRDM9_HUMAN	363	QELGIKWGSKWKELMAGR QELGIKWGSKWK EL G+ QELGIKWGSKWKSELSTGK	PKPE P+P+ PQPD
felCat3_dna	5643	cgcgaaatgaataagctagaGGTGGGCA Intron 6 CAGAAcccg aatgtagggagagatccga <1-----[5701 : 7604]-1> caca gggccggacgggcgaaga agac	
PRDM9_HUMAN	387	IHPCPSCCLAFSSQKFLSQHVERNHSSQNFPGPSARKLLQPENPCPGDQ IH CPSC LAFSSQKFLSQHVE HSSQ++P SARK QPENPCPGDQ IHRCPSCSLAFSSQKFLSQHVECKHSSQSLPQISARKHFQPENPCPGDQ	
felCat3_dna	7619	acctctttcgttacatcacccgtacttcacccatgaactccgactcggc taggccgctctcgaattgaatagaaccagtcacccaataacaacgcgaa ctatcccgccctgacccatgacacttgccaaataaatcaagtccattg	
PRDM9_HUMAN	436	NQEQQ-YPDPHSRNDKTKGQEIERSKLLNKRTWQREISRAFSSPPKGQ NQ+QQ DPHS NDK K QE+KERS+ L K QR ISRAFS+P KGQ NQQQQHSDDPHSWNDKAKCQEVKERSRPLLKSIKQRRISRAFSTPCKGQ	
felCat3_dna	7766	acccccctgccatagatagcgagataactcaaaacaaatagttactagc aaaaaaacacaggaaacagaataagcgcttagtaaggctcgtcccgaga tggggatttaccgtcaaatagcaagcatgtatagggatagatccacaaa	
PRDM9_HUMAN	484	MGSCRVGKRIMEEESRTGQKVNPGNTGKLFVGVGISRIAKVKYGECEGQG MGS RV + ++EE GQ +N +TGKLF+GVG+SRI ++K C QG MGSSRVCEGMVEEGPSMGQNLNSED TGKLFMGVGM SRIVRIKNRGCEQG	
felCat3_dna	7913	agatagtggaggggcaagcatatggagattagggataagaaaaagtgcg tggcgtgagtttaagcgtgaataacaacgatttgtgtcgttgtaagggaag ggttagtgaggaagccgctgttagtaaaacggaagaataacatactgag	
PRDM9_HUMAN	533	FSVKSDVITHQRTHTGEKLYVCRECGRGFSWKSHLLIHQRIHTGEKPYV F+ +S HQRTH EK VC E R FS KS L+ HQR HTGEKPYV FNDRSHFSRHQRTHKEEKPSVCNEFRRDFSHKSALITHQRTHTGEKPYV	
felCat3_dna	8060	tagatctaaccacaggactgtagtaagtacatgcaaccaacaggactg taagcatggaagcaaaaacctgaatggatgaaccttcaagcacgaacat ctcaatccacaaacagagcctctgtaaccttgatttacggacagggtt	
PRDM9_HUMAN	582	CRECGRGFSWQSVLLTHQRTHTGEKPYVCRECGRGFSRQSVLLTHQRRH CRECGRGF+ +S L HQRTHQRTHTGEKPYVCRECGRGF+++S L THQR H CRECGRGFTQRSNLFTHQRTHTGEKPYVCRECGRGFTQRSNLFTHQRTH	
felCat3_dna	8207	tagtgcgtacatactaccaacaggactgtagtgcgtacatgctaccaac ggaggggtcagcattgaagcacgaacatggaggggtcagcattcaagca cggcgactagatccacggacagggttcggcgactagatccacggac	
PRDM9_HUMAN	631	TGEKPYVCRECGRGFSRQSVLLTHQRRHTGEKPYVCRECGRGFSWQSVL TGEKPYVCRECGRGF+R+S L THQR HTGEKPYVCRECGRGF+ +S L TGEKPYVCRECGRGFTRRSNLFTHQRTHTGEKPYVCRECGRGFTRRSHL	

felCat3_dna	8354	aggactgtagtgcgtagacataactaccaacaggactgtagtgcgtagatcc cgaacatggaggggtcggcattcaagcacgaacatggaggggtcggcat agggcttcggcgaccaggatccacggacagggttcggtgactaggatc
PRDM9_HUMAN	680	LTHQRTHTGEKPYVCRECGRGFSWQSVLLTHQRTHTGEKPYVCRECGRG THQRTHTGEKPYVCRECGRGF+ +S L THQRTHTGEKPYVCRECGRG FTHQRTHTGEKPYVCRECGRGFTQRSNLFTHQRTHTGEKPYVCRECGRG
felCat3_dna	8501	taccaacaggactgtagtgcgtagacataactaccaacaggactgtagtgcg tcaagcacgaacatggaggggtcagcattcaagcacgaacatggagggg cacggacagggttcggcgactaggatccacggacagggttcggcgac
PRDM9_HUMAN	729	FSNKSHELLRHQRTHTGEKPYVCRECGRGFRDKSHLLRHQRTHTGEKPYV F+ +S L RHQRTHTGEKPYVCRECGRGF +SHL HQRTHTGEKPYV FTQRSDLFRHQRTHTGEKPYVCRECGRGFTQRSHLFTHQRTHTGEKPYV
felCat3_dna	8648	tacatgctaccaacaggactgtagtgcgtagatccctaccaacaggactg tcagcattgaagcacgaacatggaggggtcagcattcaagcacgaacat caggatccacggacagggttcggtgactaggatccacggacagggttc
PRDM9_HUMAN	778	CRECGRGFRDKSNLLSHQRTHTGEKPYVCRECGRGFSNKSHELLRHQRTH CRECGRGF +SNL HQRTHTGEKPYVCRECGRGF+ +S+L HQRTH CRECGRGFTQRSNLFTHQRTHTGEKPYVCRECGRGFTWRSNLFTHQRTH
felCat3_dna	8795	tagtgcgtagacataactaccaacaggactgtagtgcgtagatataactaccaac ggaggggtcagcattgaagcacgaacatggaggggtcggcattcaagca cggcgaccaggatccacggacagggttcggtgactaggatccacggac
PRDM9_HUMAN	827	TGEKPYVCRECGRGFRNKSHLLRHQRTH TGEKPYVCR+ G+GF NK HL +QRT+ TGEKPYVCRKDGGQGFNKLHL-SYQRTN
felCat3_dna	8942	aggactgtaaggcgtaaatacc atcaaa cgaacatggaagagtcaatat gaagca agggcttcggtaactctagtc ccgaat

Supplemental Figure 5.

Human - Golden Jackal alignment

NP_064612.2	382	EPKPEIHPCPSCCLAFSSQKFLSQHVERNHSQNFPGPSARKLLQPENP EP PEIHPCPSC L FSSQKFLSQH+E NH SQ +P S R+ +P++P EPNPEIHPCPSCSL FSSQKFLSQHLEHNHPSQILPRISVREHFRPKDP
Golden_jackal	395	gcacgacctctttc2ttacatcacctgcacctcacccatgagctccagc acacatacgccgct tcgaattgaataaaaccattcgtctgaatgcaac atcagatatacctg cctgacccgtgactcttgccaaataaatcaata
NP_064612.2	431	CPGDQNQE-QQYPDPHSRNDKTKGQEIKERSKLLNKRTWQREISRAFSS CPG QNQ+ QQ+ DP ND+ KGQE KER K L K QR ISRAFS+ CPGCQNQQQQHSDPQRWNDRAKGQEGKERFKPLPKSIRQRRISRAFST
Golden_jackal	541	tcgtcacccccctgccctagagagcggagataactcaaaacaaatagtta gcggaaaaaaaaacacaggaagcagaagaagtactcagtgaggtcgctcc cattgtgggggatttagcgctcatatagcaagcatgtataggaatagctcc
NP_064612.2	479	PPKGQMGSCRVGKRIMEEESRTGQKVNPGNTGKLFVGVGISRIAKVKYG P KGQ C + EE S QK+NP +TGKLF GVG++RI +VKY PCKGQT-TCE--GIVKEEPSAGSQKLNPEDTGKLFKGVGMTRIIRVKYR
Golden_jackal	688	ctagca atg gagaggcaggtcatacggagattagggaaaaaagata cgagac cga gttaaaccgcgaataacaacgattagtgtcggtgtaag gcagaa gtg aaggagccacagagtagcacaacggaagaataacata
NP_064612.2	528	ECGQGFVSKSDVITHQRTHTGEKLYVCRECGRGFSWKSHLLIHQRIHTG CG+GF+ +S + HQRTHTGE YVCRECGRGF +++L+IHQR HTG GCGRGFNDRSHLSRHQRTHTGENPYVCRECGRGFIHRTNLIIHQRTHTG
Golden_jackal	826	gtgcgtagatccaaccaacaggactgtagtgcgtacaaacaaccaacag gggggtaagcatggaagcacgaacatggaggggtagcatttaagcacg ctgaccttgatccatggacgagctttcggtgactacaattcatgaacag
NP_064612.2	577	EKPYVCRECGRGFSWQSVLLTHQRTHTGEKPYVCRECGRGFSRQS EKPYPVCRECGRGF+ +S L HQRTHT EKPYPVCRECGR F+++S EKPYPVCRECGRGFTQRSTLNEHQRTHTTEKPYVCRECGRSFTKRS
Golden_jackal	973	gactgtagtgcgtacatacagccaacaggactgtagtgcataaat aacatggaggggtcagcctaaaagcacaacatggaggggtcagc ggcttcgatgactaggatccacggacggggcttcggtgactagga

Human - African wild Dog alignment

NP_064612.2	382	EPKPEIHPCPSCCLAFSSQKFLSQHVERNHSQNFPGPSARKLLQPENP EP PEIHPCPSC L FSSQKFLSQH+E NH SQ +P S R+ +P++P EPNPEIHPCPSCSLFSSQKFLSQHLEHNHPSQILPRISVREHFRPKDP
African_wild_do	29	gcacgacctcttttc2ttacatcacctgcacctcacccatgagctccagc acacatacgccgct tcgaattgaataaaaaccattcgtctgaatgcaac atcagatataacctg cctgacccgtgactcttgccaaataaatcaata
NP_064612.2	431	CPGDQONQEQQ-YPDPHSRNDKTKGQEIKERSKLLNKRTWQREISRAFSS CPG QNQ+QQ DP +D+ KGQE KER K L K QR ISRAFS+ CPGCQNQQQQHSDPQRWSDRAKGQEGKERFKPLPKSIRQRRISRAFST
African_wild_do	175	tcgtcacccccctgccttagagagcggagataactcaaaacaaatagtta gcggaaaaaaaacacagggagcagaagaagtactcagtgaggctcgtcc cattgtggggatttagcgtcatatagcaagcatgtataggaatagctcc
NP_064612.2	479	PPKGQMGSCRVGKRIMEEESRTGQKVNPGNTGKLFVGVGISRIAKVKYG P KGQ C + EE S QK+NP +TGKLF GVG++RI VKY PCKGQT-TCE--GIVKEEPSAGSQKLNPEDTGKLFKGVGMTRIMVKYR
African_wild_do	322	ctagca atg gagaggcaggtcatacggagattagggaaaaalgata cgagac cga gttaaacgcgcaatacaacgattagtgtcgtt taag gcagaa gtg aaggagccacagagtagcacaacggaagaatg cata
NP_064612.2	528	ECQGQFSVKSDVITHQRTHTGEKLYVCRECGRGFSWKSHLLIHQRIHTG CG+GF+ +S + HQRTHTGE YVCRECGRGF+ +++L+IHQR HTG GCGRGFNDRSHLSRHHQRTHTGENPYVCRECGRGFTHRTNLIHQRTHTG
African_wild_do	458	gtgcgtagatccaaccaacaggactgtagtgcgtacaaacaaccaacag gggggtaagcatggaagcacgaacatggaggggtcagcatttaagcacg ctgaccttgatccatggacgagctttcgggtgactacaattcatgaacag
NP_064612.2	577	EKPYVCRECGRGFSWQSVLLTHQRTHTGEKPYVCRECGRGFSRQSVLLT EKPYVCRECG GF +S L HQRTHTGEKPYVCRECGRGF+++S L EKPYVCRECGGFIQRSNLSIHQRTHTGEKPYVCRECGRGFTQRSTLNE
African_wild_do	605	gactgtagtg2gtacatacaaccaacaggactgtagtgcgtacatacag aacatggagg gttagcatgtaagcacgaacatggaggggtcagcctaa ggcttcgata ctaggatccatggacagggcttcgatgactaggatcca
NP_064612.2	626	HQRRHTGEKPYVCRECGRGFSRQSVLLTHQRRHTGEKPYVCRECGRGFS HQR HT EKPYVCRECGR F+R+S L+THQR HTGEKPYVCRECGR F+ HQRTHTTEKPYVCRECGRSFTRRSTLITHQRTHTGEKPYVCRECGRSFT
African_wild_do	751	ccaacaggactgtagtgcatacatacaaccaacaggactgtagtgcata aagcacaacatggaggggtcggccttcaagcacgaacatggaggggtc cggacgggggttcgggtgactaggatccacggacaggacttcgggtgacta
NP_064612.2	675	WQS +S KRS
African_wild_do	898	aat agc gga

Human - Black backed Jackal alignment

NP_064612.2	382	EPKPEIHPCPSCCLAFSSQKFLSQHVERNHSQNFPGPSARKLLQPENP EP PEIHPCPSC L FSSQKFLSQH+E NH SQ +P S R+ +P++P EPNPEIHPCPSCSLFSSQKFLSQHLEHNHPSQILPQISVREHFRPKDP
Black_backed_ja	362	gcacgacctcttttc2ttacatcacctgcacctcacccatgagctccagc acacatacgccgct tcgaattgaataaaaaccattcatctgaatgcaac atcagatataacctg cctgacccgtgactcttgccaaataaatcaaata
NP_064612.2	431	CPGDQONQEQQ-YPDPHSRNDKTKGQEIKERSKLLNKRTWQREISRAFSS CPG QNQ+QQ DP ND+ KGQE KER K L K QR ISRAFS+ CPGCQNQQQQHSDPQRWNDRAKGQEGKERFKPLPKSIRQRRISRAFST
Black_backed_ja	508	tcgtcacccccctgcccctagagagcggagataactcaaaacaaatagtta gcggaaaaaaaacacaggaagcagaagaagtactcagtgaggctcgtcc cattgtggggatttagcgtcatatagcaagcatgtataggaatagctcc
NP_064612.2	479	PPKGQMGSCRVGKRIMEEESRTGQKVNPGNTGKLFVGVGISRIAKVKYG P KGQ C + EE S QK+NP +TGKLF GVG++RI +VKY PCKGQT-TCE--GIVKEEPSAGSQKLNPEDTGKLFKGVGMTRIIRVKYR
Black_backed_ja	655	ctagca atg gagaggcaggtcatacggagattagggaaaaaagata cgagac cga gttaaacgcgcaatacaacgattagtgtcgttgtaag gcagaa gtg aaggagccacagagtagcacaacggaagaataacata
NP_064612.2	528	ECGQGFVSKSDVITHQRTHTGEKLYVCRECGRGFSWKSHLLIHQRIHTG CG+GF+ +S + HQRTHTGE YVCRECGR F+ +++L+IHQR HTG GCGRGFNDRSHLSRHHQRTHTGENPYVCRECGRDFTHRTNLIHQRTHTG
Black_backed_ja	793	gtgcgtagatccaaccaacaggactgtagtgcgtacaaacaaccaacag gggggtaagcatggaagcacgaacatggaggatcagcatttaagcacg ctgaccttgatccatggacgagctttcgggtgactacaattcatgaacag
NP_064612.2	577	EKPYVCRECGRGFSWQSVLLTHQRTHTGEKPYVCRECGRGFSRQSVLLT EKPYVCRECG GF +S L HQRTHTGEKPYVCRECGRGF+++S L EKPYVCRECGGFIQRSNLSIHQRTHTGEKPYVCRECGRGFTQRSTLNE
Black_backed_ja	940	gactgtagtgtgtacatacaaccaacaggactgtagtgcgtacatacag aacatggagg gttagcatgtaagcacgaacatggaggggtcagcctaa ggcttcgata ctaggatccatggacagggcttcgatgactaggatcca
NP_064612.2	626	HQRRHTGEKPYVCRECGRGFSRQSVLLTHQRRHTGEKPYVCRECGRGFS HQR HT EKPYVCRECGR F+R+S L+THQR HTGEKPYVCRECGR F+ HQRTHTTEKPYVCRECGRSFxRRSTLITHQRTHTGEKPYVCRECGRSFT
Black_backed_ja	1086	ccaacaggactgtagtgcatacatacaaccaacaggactgtagtgcata aagcacaacatggaggggtcggccttcaagcacgaacatggaggggtc cggacgggggttcgggtgactNggatccacggacaggggttcgggtgacta
NP_064612.2	675	WQS +S KRS
Black_backed_ja	1233	aat agc gga

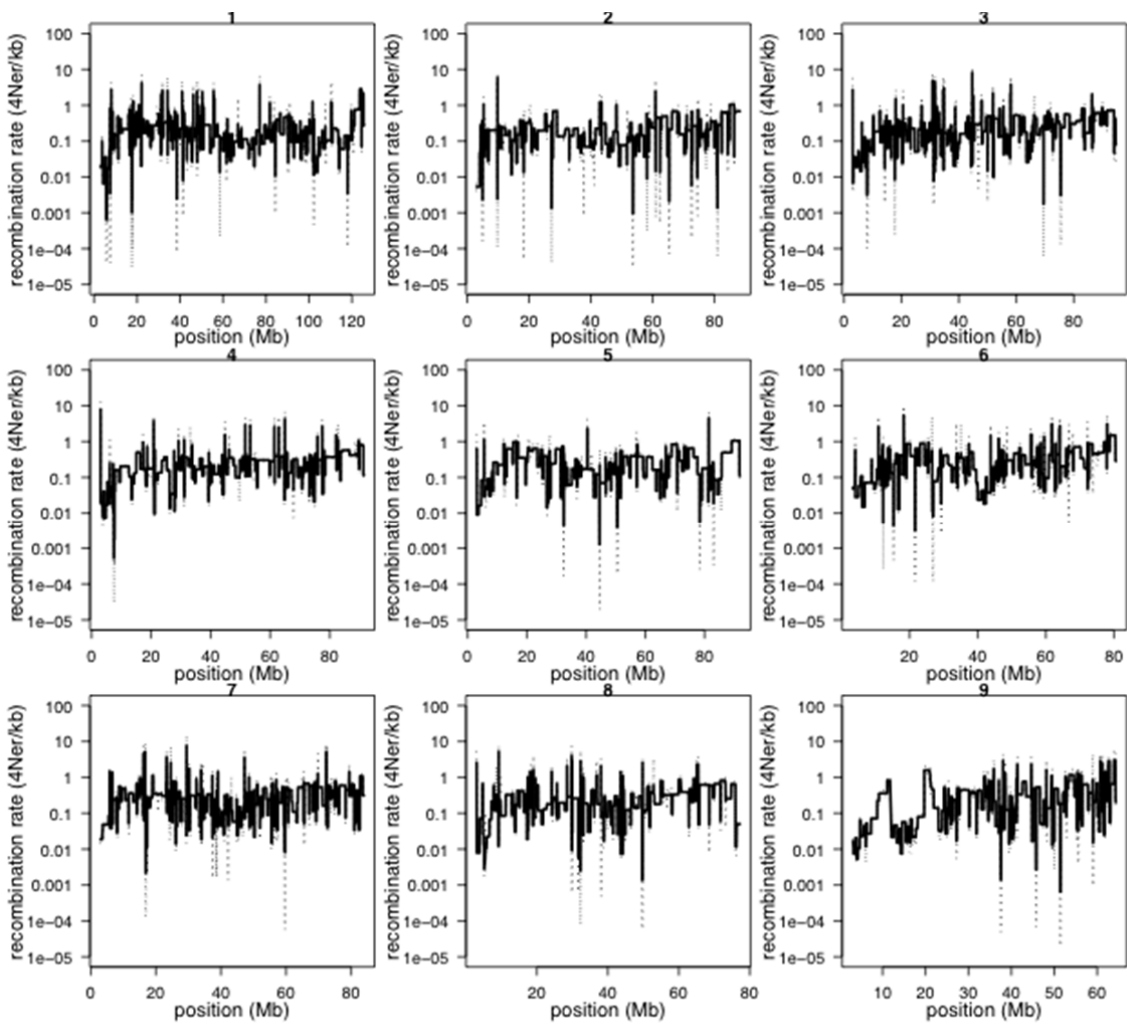
Human - Bush Dog alignment

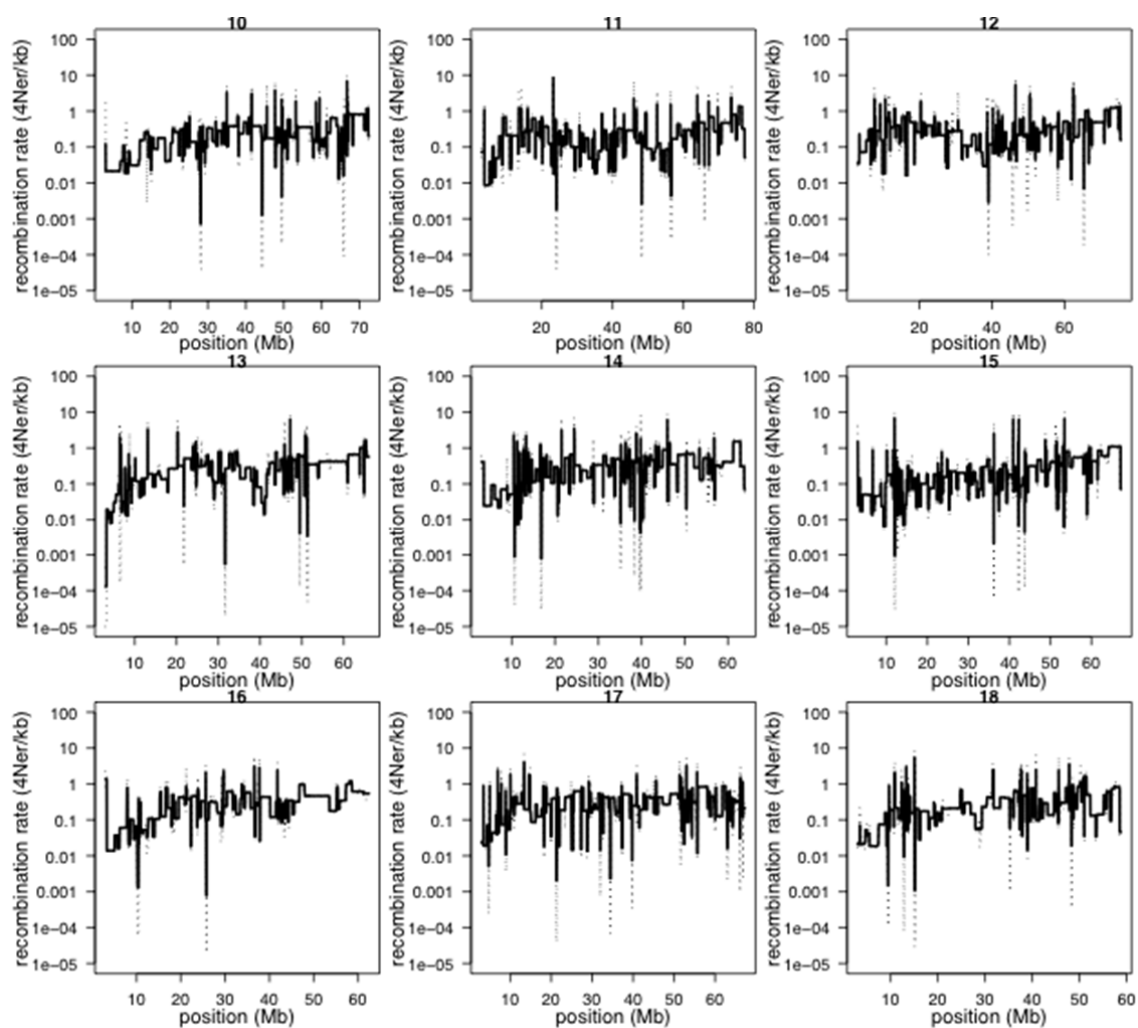
NP_064612.2	382	EPKPEIHPCPSCCLAFSSQKFLSQHVERNHSSQNFPGPSARKLLQPENP EP PEIHPCPSC L FSSQKFLSQH+E NH SQ +P S R+ +P++P EPNPEIHPCPSCSLFSSQKFLSQHLEHNHPSQILPXISVREHFRPKDP
Bush_dog	29	gcacgacctcttttc2ttacatcacctgcacctcacctatgagctccagc acacatacgccgct tcgaattgaataaaaccattcgtctgaatgcaac atcagatataacctg cctgacccgtgactcttgccaaataaatcaaata
NP_064612.2	431	CPGDQNQ-EQQYPDPHSRNDKTKGQEIKERSKLLNKRTWQREISRAFSS CPG QNQ QQ+ DP ND+ KGQE KER K L KR QR ISRAFS+ CPGCQNQQQQHSDPQRWNDRAKGQEGKERFKPLPKRIRQRRISRAFST
Bush_dog	175	tcgtcacccccctgccctagagagcggagatactcacaacaaatagtta gcggaacacacaggaagcagaagaagtactcagtgaggctcgtcc cattgtggggatttagcgtcatatagcaagcatgtataggaatagctcc
NP_064612.2	479	PPKGQMGSCRVGKRIMEEESRTGQKVNPGNTGKLFVGVGISRIAKVKYG P KGQ C + EE S + QK+NP +TGKLF GVG++RI +VKY PCKGQT-TCE- -GIVKEEPSASSQKLNPExTGKLFKGVGMTRIIRVKYR
Bush_dog	322	ctagca atg gagaggcagatcatacggagattagggaaaaaagata cgagac cga gttaaaccgcgaataacaacgattagtgtcgttgtaag gcagaa gtg aaggagccacagagtagNacaacggaagaataacata
NP_064612.2	528	ECGQGFVSKSDVITHQRTHTGEKLYVCRECGRGFSWKSHLLIHQRIHTG CG+GF+ +S + HQRTHTGE YVCREC+RGF+ +++L+IHQ HTG GCGRGFNDRSHLSRHRQRTHTGENPYVCRECxRGFTHRTNLIHQTTHTG
Bush_dog	460	gtgcgtagatccaaccaacaggactgtagtgcgtacaaacaaccaacag gggggtaagcatggaagcacgaacatggagNggtcagcatttaaccacg ctgaccttgatccatggacgagctttcggtgactacaattcatgaacag
NP_064612.2	577	EKPYPVCRECGRGFSWQSVLLTHQRTHTGEKPYVCRECGRGFS EKPYPVCRECG GF +S L HQRTHTGEKPYVCRECGR F+ EKPYPVCRECGGFIQRSNLSIHQRTHTGEKPYVCRECGRSFT
Bush_dog	607	gactgtagtg2gtacatacaaccaacaggactgtagtgcata aacatggagg gttagcatgtaagcacgaacatggagggggtc ggcttcgata ctaggatccatggacagggcttcggtgacta

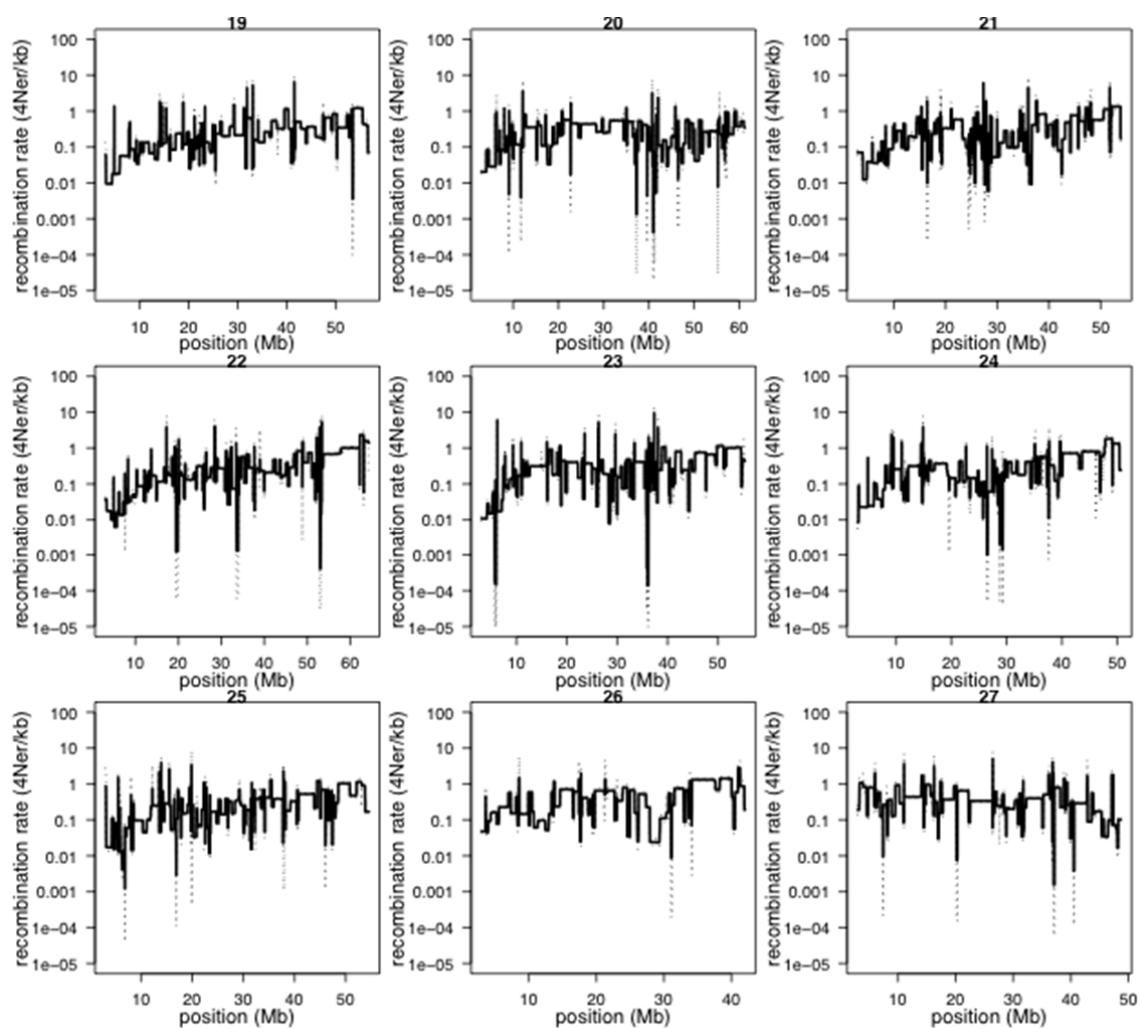
Human - Red fox alignment

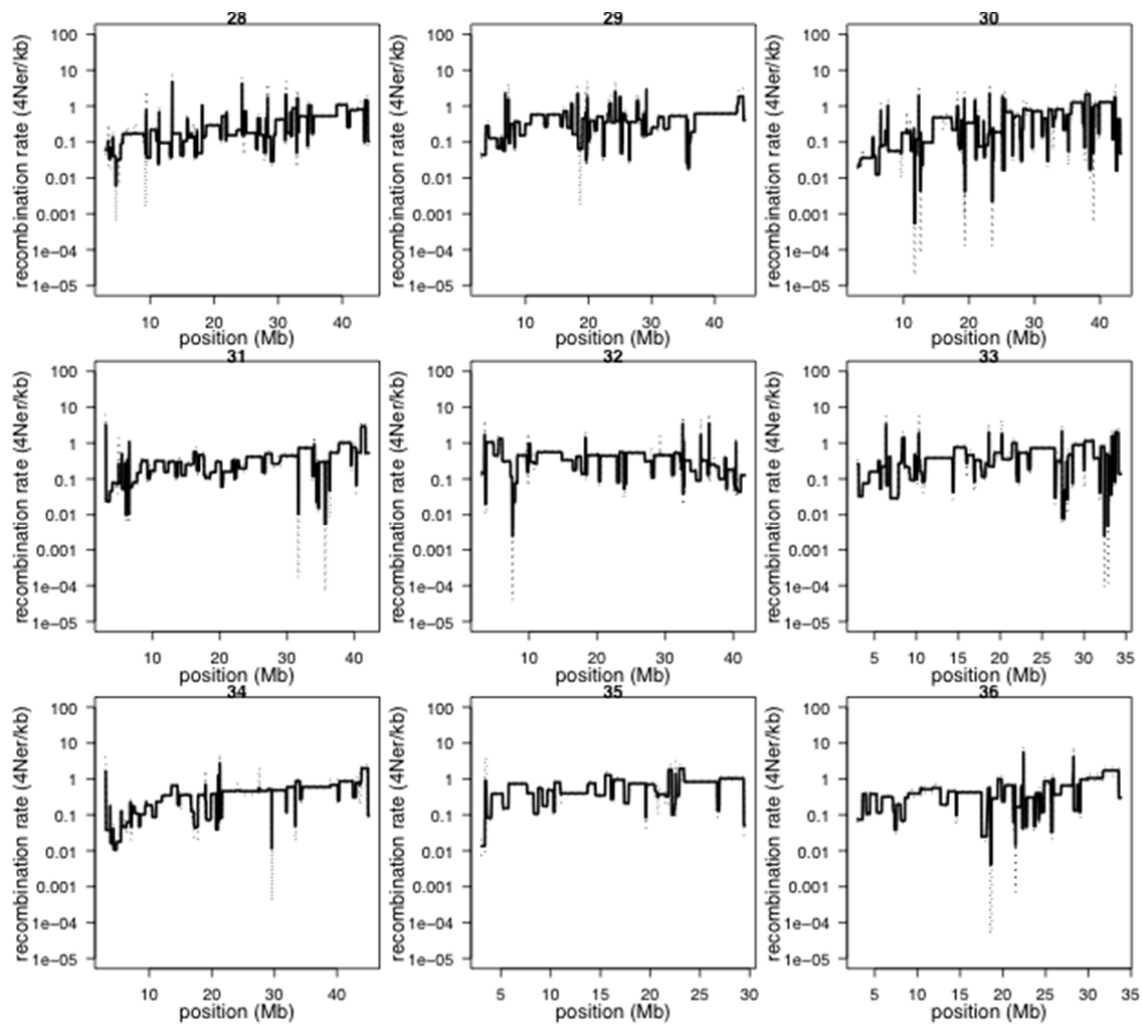
NP_064612.2	382	EPKPEIHPCPSCCLAFSSQKFLSQHVERNHSSQNFPGPSARKLLQPENP EP PEI+PCPSC L+FSSQKFLSQH+E NH SQ +P S R+ QP++P EPNPEIYPCPSCSLSFSSQKFLSQHLEHNHPSQILPRISIREHFQPKDP
Red_fox	377	gcacgatctcttttctttacatcacctgcacctcacccataagctccagc acacatacgccgctctcgaattgaataaaaaccattcgtctgaataacaac atcagatataacctgcccctgacccgtgactcttgccaaataaatcaaata
NP_064612.2	431	CPGDQONQEQQ-YPDPHSRNDKTKGQEIKERSKLLNKRTWQREISRAFSS CPG QNQ+QQ DP ND+ KGQE KER K L K QR+ISRAFS+ CPGCQNQQQQHSDPQCWNDRAGQEGKERFKPLPK!IRQRKISRAFST
Red_fox	524	tcgtcacccccctgccttagagagcggagataactca2aacaatagttta gcggaacacacaggaagcagaagaagtactca tgagatcgctcc cattgtggggatttagcgctcatatagcaagcatgta aggaatagctcc
NP_064612.2	479	PPKGQMGSCRVGKRIMEEESRTGQKVNPGNTGKLFVGVGISRIAKVKYG P KGQ C + EE S QK+NP +TGKLF GVG++RI +VKY PCKGQT-TCE--GIVKEEPSAGSQKLNPEDTGKLFKGVGMTRIIRVKYR
Red_fox	670	ctagca atg gagaggcaggtcatcacggagattagggaaaaaagata cgagac cga gttaaacgcgcaataacaacgattagtgtcggttgtaag gcaaaa gtg aaggagccacagagtagcacaacggaagaataacata
NP_064612.2	528	ECGQGFVSKSDVITHQRTHTGEKLYVCRECGRGFSWKSHLLIHQRIHTG CG+GF+ +S + HQRTH GE YVCRECGRGF+ +++L+IHQR HTG GCGRGFNDRSHLSRHRQRTHTMGENPYVCRECGRGFTHRTNLIIHQRTHTG
Red_fox	808	gtgcgtagatccaaccaacaggactgtagtgcgtacaaacaaccaacag gggggtaagcatggaagcatgaacatggaggggtcagcatttaagcacg ctgaccttgatccatggacgagctttcggtgactacaattcatgaacag
NP_064612.2	577	EKPYPVCRECGRGFSWQSVLLTHQRTHTGEKPYVCRECGRGFSRQSVLLT EKPYPV ECGR F+ +S L+THQRTHTGEKPYVCRECGRGF+++S L T EKPYSWECGRSFTRRSNLITHQRTHTGEKPYVCRECGRGF+TKRSTLST
Red_fox	955	gactgatgtgcatacatacaaccaacaggactgtagtgcgtaaatacaa aacatggaggggtcggtcattcaagcacgaacatggaggggtcagcctgc ggcttcggtgactaggatccacggacagggttcggtgactaggatcca
NP_064612.2	626	HQRRH HQR H HQRTH
Red_fox	1102	ccaac aagca cggac

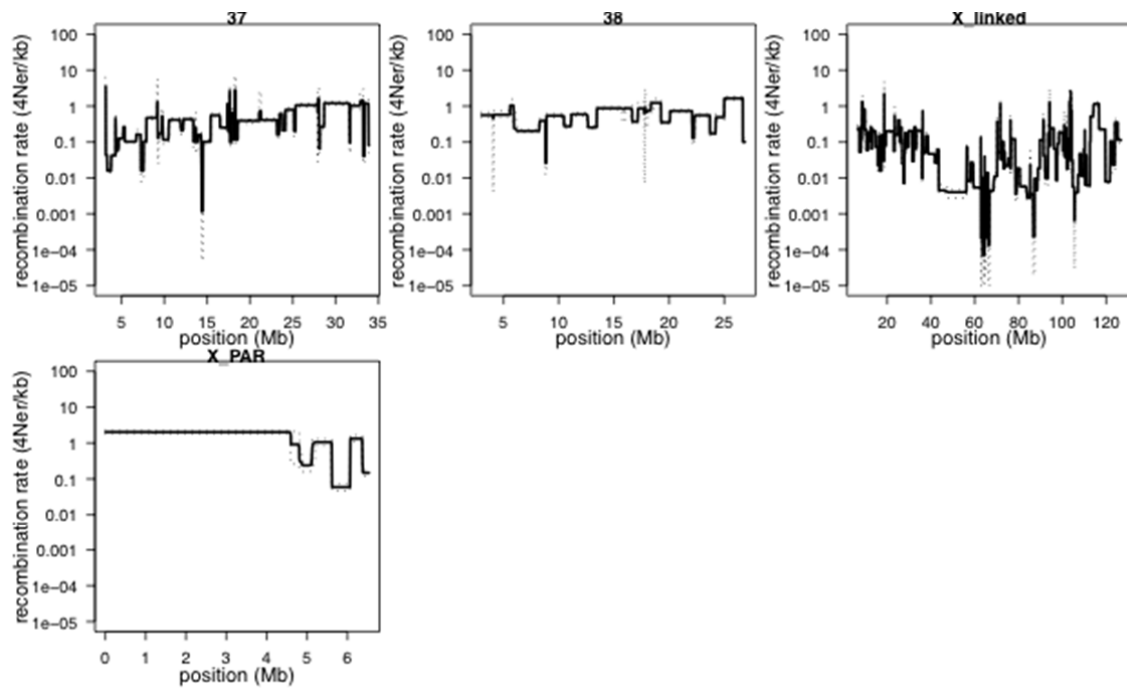
Supplemental Figure 6.



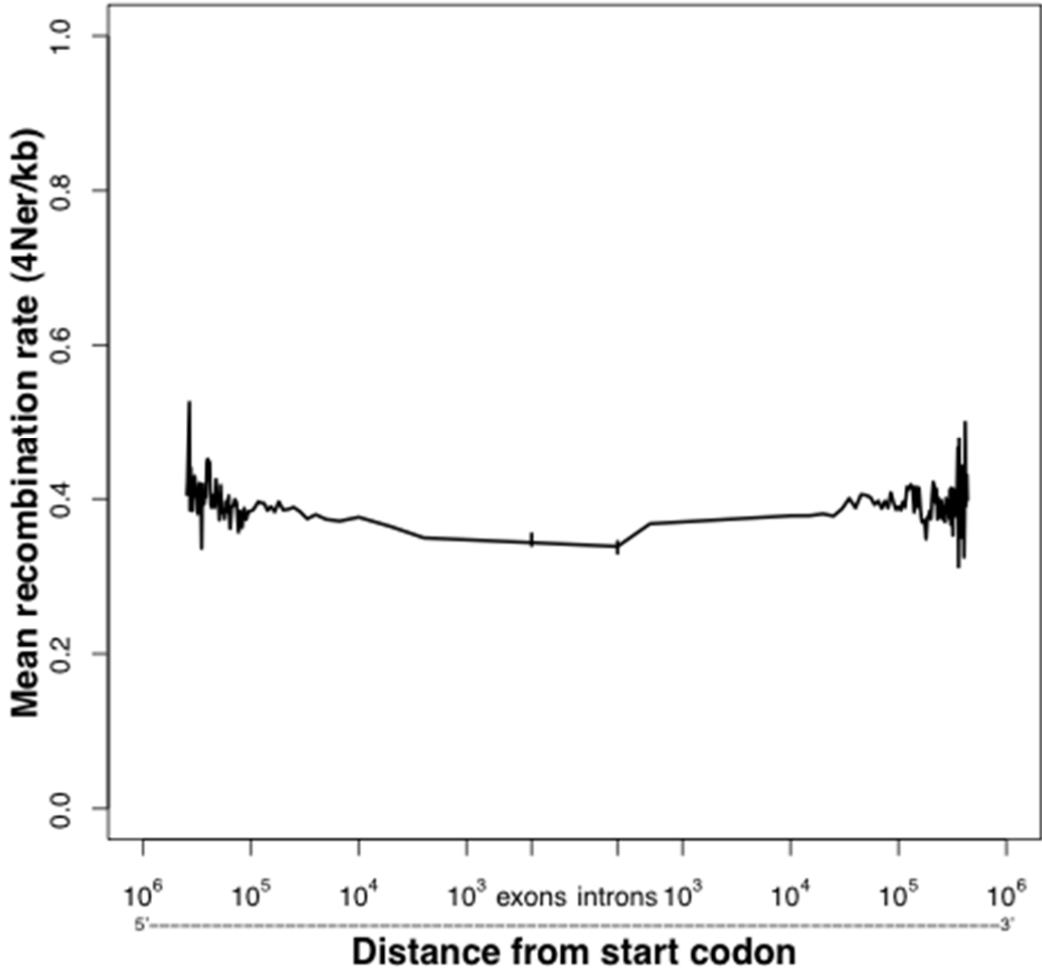




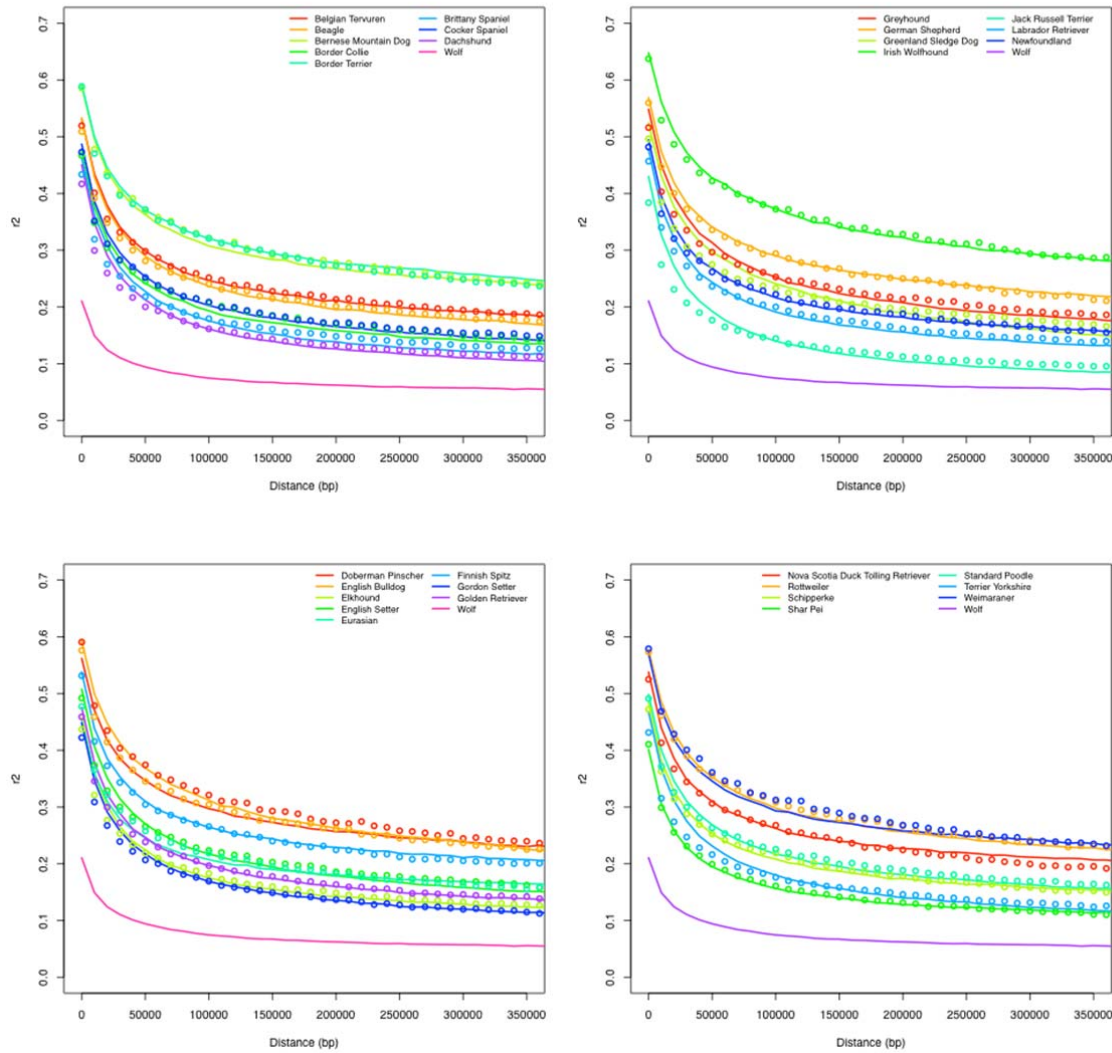




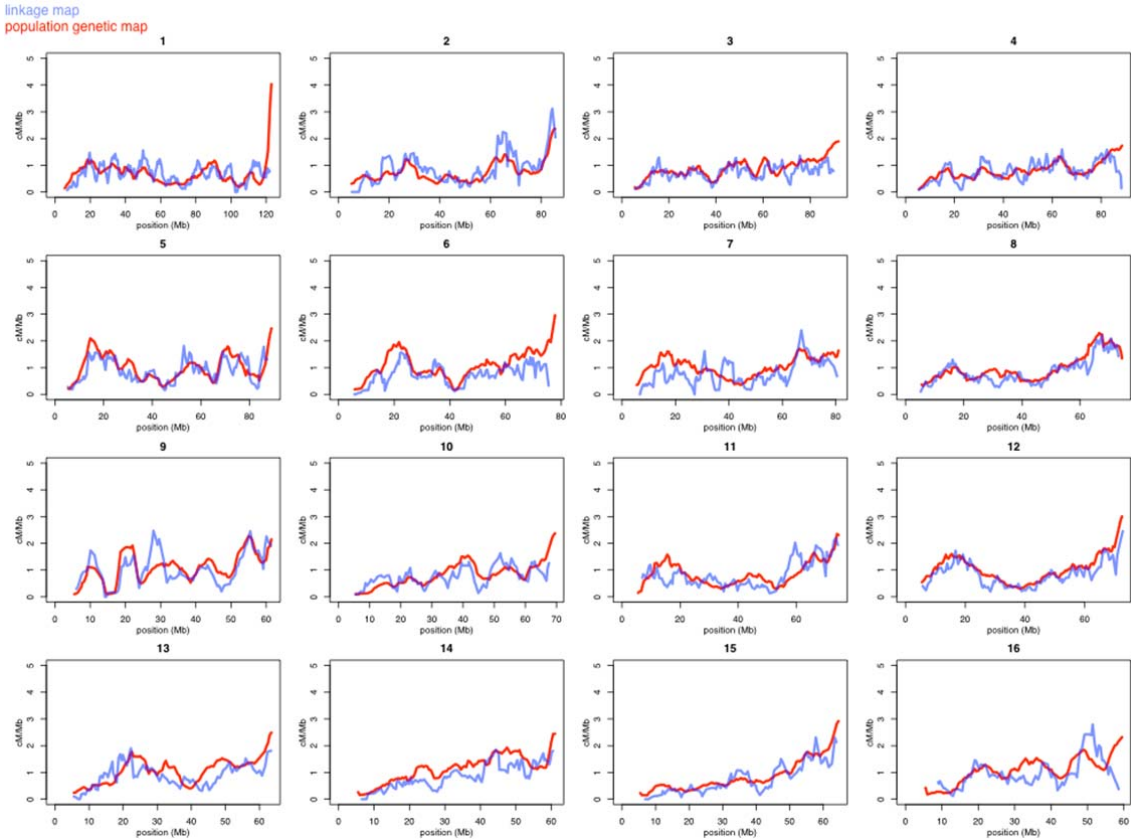
Supplemental Figure 7.



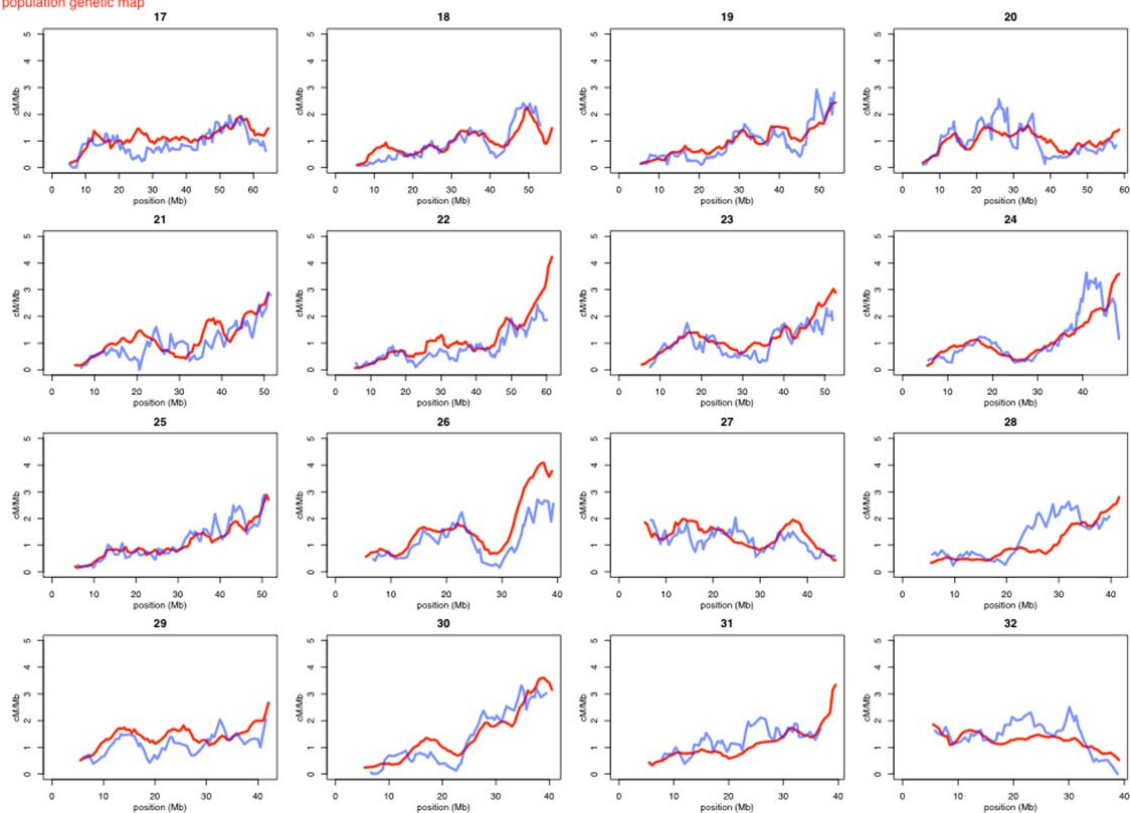
Supplemental Figure 8.



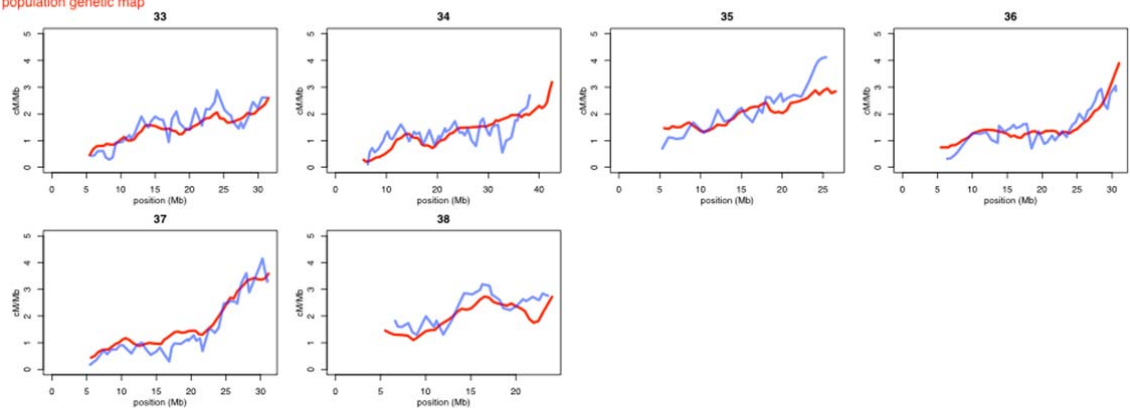
Supplemental Figure 9.



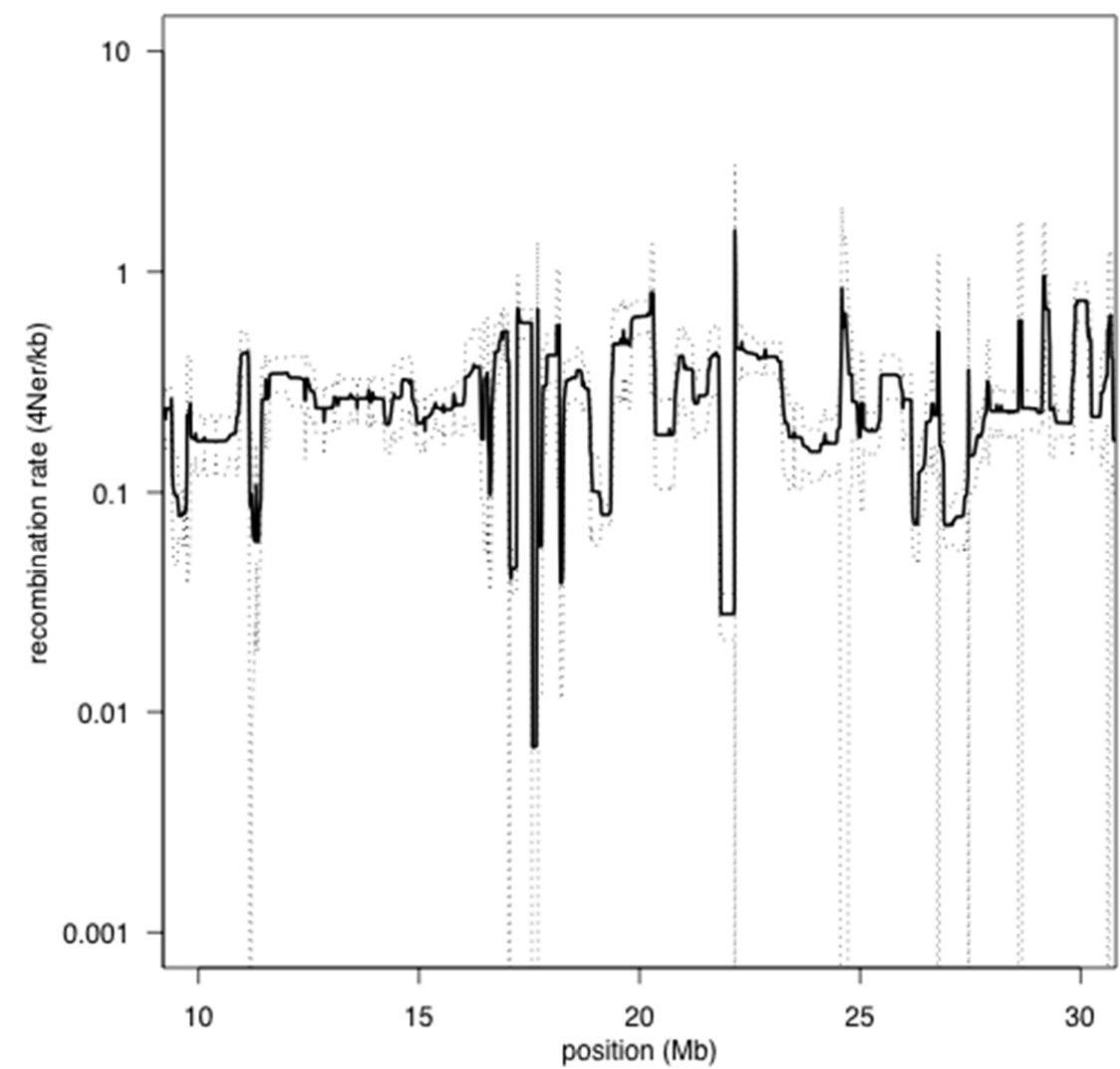
linkage map
population genetic map



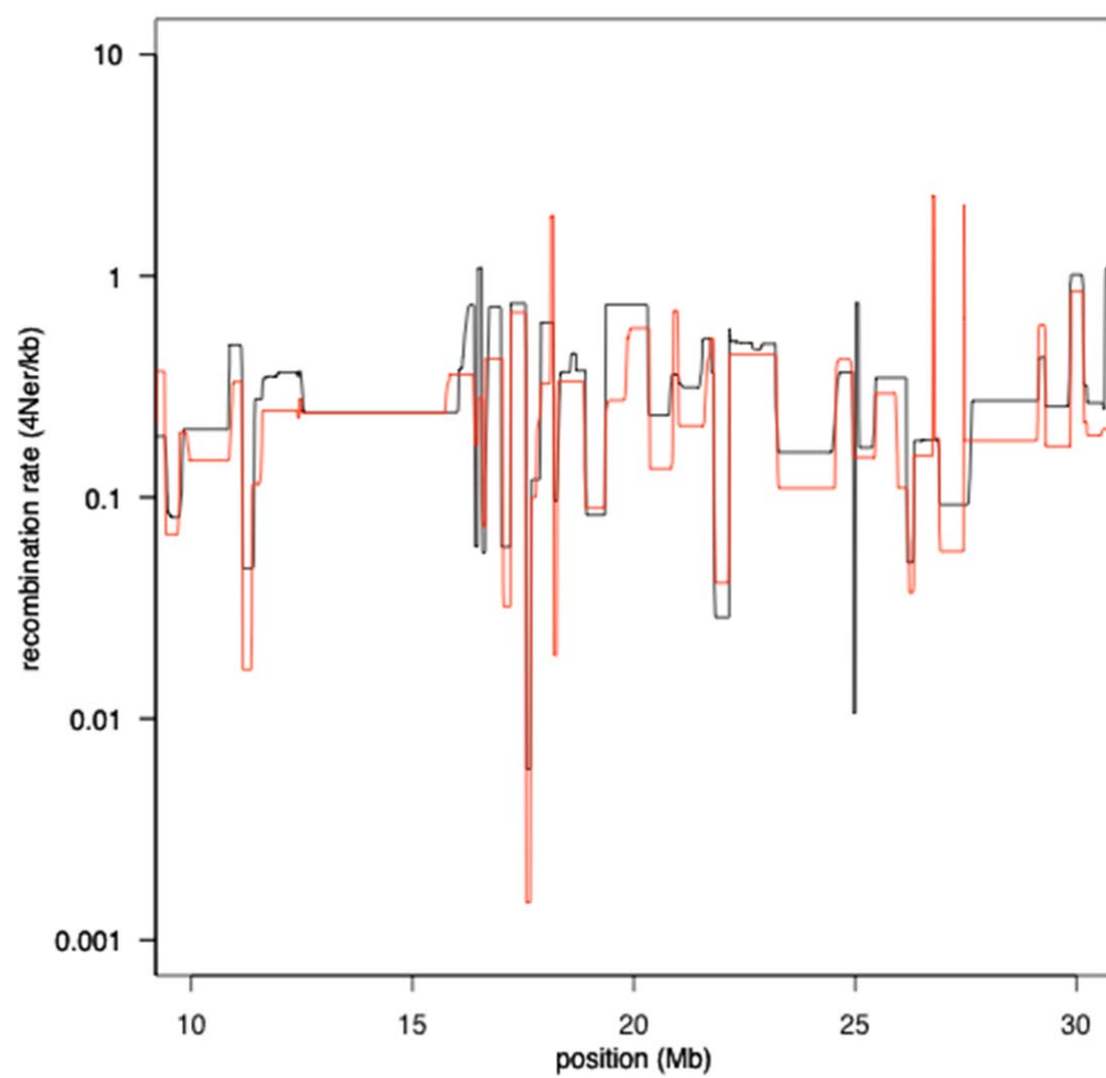
linkage map
population genetic map



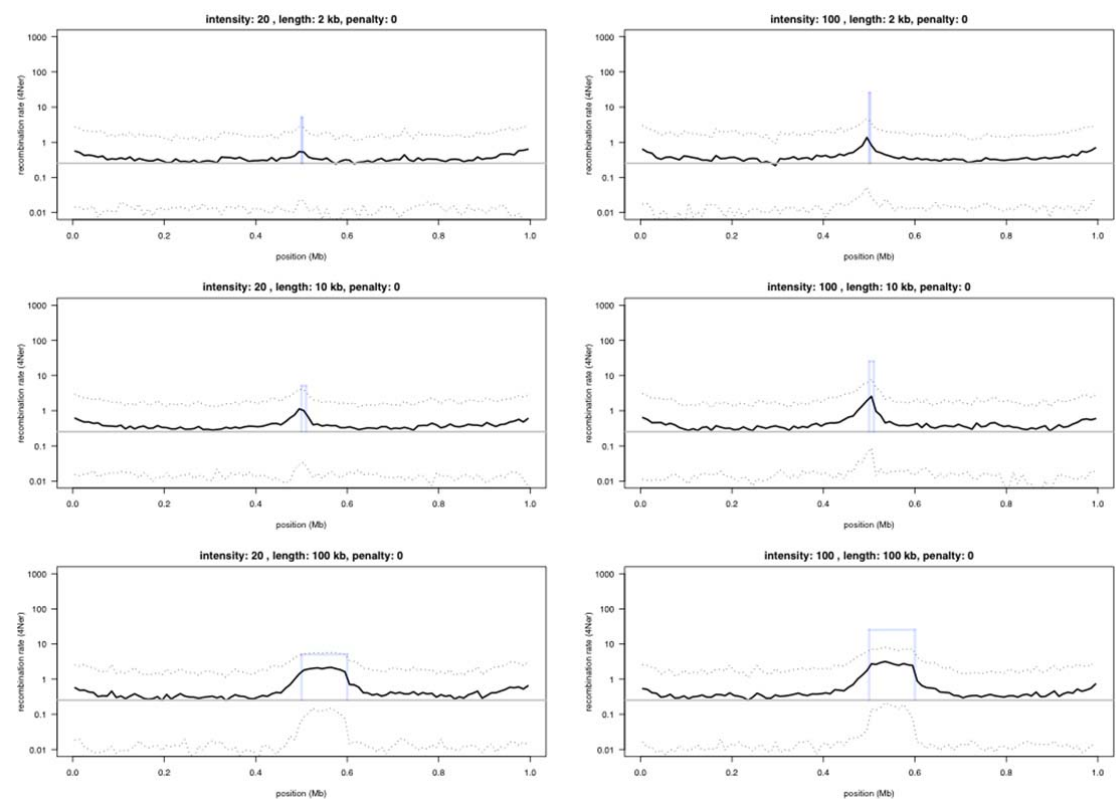
Supplemental Figure 10.



Supplemental Figure 11.



Supplemental Figure 12.



Supplemental Table 1.

Breed	Breed bottleneck sample size
Belgian Tervuren	192.1
Beagle	226
Bernese Mountain Dog	135.6
Border Colies	237.3
Border Terrier	124.3
Brittany Spaniel	372.9
Cocker Spaniel	259.9
Dachshund	463.3
Doberman Pinscher	124.3
English Bulldog	146.9
Elkhound	372.9
English Setter	237.3
Eurasian	248.6
Finnish Spitz	180.8
Gordon Setter	305.1
Golden Retriever	282.5
Greyhound	203.4
German Shepard	158.2
Greenland Sledge Dog	226
Irish Wolfhound	113
Jack Russel Terrier	621.5
Labrador Retriever	282.5
Newfoundland	203.4
Nova Scotia Duck Tolling Retriever	158.2
Rottweiler	146.9
Schipperke	214.7
Shar Pei	497.2
Standard Poodle	237.3
Terrier Yorkshire	372.9
Weimaraner	124.3

Supplemental Table 2.

repeat	hot	cold	ratio	p value	bonferoni
GC_rich	951	370	2.57	6.84E-63	3.03E-60
L1MCb	5	43	0.12	1.48E-08	6.57E-06
(CCG)n	49	10	4.90	1.27E-07	5.64E-05
MIRb	3407	3078	1.11	2.80E-07	0.000124188
L1MEe	75	155	0.48	2.94E-07	0.000130098
(CCCCCG)n	31	3	10.33	3.26E-07	0.000144262
L1_Carn7	326	475	0.69	6.54E-07	0.00028962
L1MD1	32	85	0.38	1.64E-06	0.000727196
L1M5	549	734	0.75	1.75E-06	0.000773049
C-rich	115	56	2.05	3.50E-06	0.001552055
L1_Carn2	204	312	0.65	6.40E-06	0.002833781
Charlie1a	36	8	4.50	1.29E-05	0.005705738
L1_Carn5	219	321	0.68	3.98E-05	0.017637078
L1ME1	238	343	0.69	4.41E-05	0.019516104
L1_Canid	319	439	0.73	5.07E-05	0.022478262
(CGG)n	52	19	2.74	6.67E-05	0.029563365
L1MDa	62	112	0.55	0.000257378	0.114018327
G-rich	101	57	1.77	0.000312129	0.138273226
L1MC5	160	235	0.68	0.000405489	0.179631836
L1MB4	71	122	0.58	0.000511045	0.226392758
L1M	96	153	0.63	0.000593574	0.262953105
L1MB2	57	102	0.56	0.000612594	0.271379343
L1M2	27	59	0.46	0.000776527	0.344001355
L1M4	139	205	0.68	0.000799036	0.353973133
L1MB8	118	178	0.66	0.00108332	0.479910912
CarERV1	4	20	0.20	0.001566251	0.693849363
L1_Cf	106	159	0.67	0.002082318	0.922466659
L1M3b	16	3	5.33	0.002331235	1
L1_Carn3	264	344	0.77	0.002973213	1
AT_rich	3321	3162	1.05	0.003090409	1
(CCCTG)n	11	1	11.00	0.003106695	1
(CCCCG)n	31	12	2.58	0.003365222	1
CarERV2c2_LTR	8	0	Inf	0.003567009	1
(A)n	498	422	1.18	0.004390268	1
L1_Canis2	22	46	0.48	0.005072814	1
CfERV2	7	0	Inf	0.007215733	1
ERV1-F	7	0	Inf	0.007215733	1
(CAG)n	21	7	3.00	0.007531559	1
Charlie1	74	46	1.61	0.00792526	1
L1MB5	65	100	0.65	0.01008548	1
L1ME3B	218	281	0.78	0.010494555	1
ORSL	26	11	2.36	0.012997976	1
(GGAA)n	56	33	1.70	0.014258221	1
MIR	2460	2349	1.05	0.014945363	1
(CAAA)n	58	89	0.65	0.016543917	1
(CCCCCA)n	31	15	2.07	0.017619272	1
CarL1A2A	8	1	8.00	0.02015626	1
CfERV2_LTR	10	2	5.00	0.021092184	1
MER97a	10	2	5.00	0.021092184	1
(CGGGG)n	44	25	1.76	0.021489672	1
BLACKJACK	40	22	1.82	0.02154432	1
(TTTTTG)n	53	32	1.66	0.022119501	1
MLT1F	37	61	0.61	0.025685489	1
LTR33	92	128	0.72	0.02578266	1
MER5A	466	411	1.13	0.029951512	1
HERV16	29	49	0.59	0.031550038	1

(CACG)n	16	6	2.67	0.032905225	1
Charlie2b	11	3	3.67	0.033290132	1
LTR75	11	3	3.67	0.033290132	1
MER34-int	11	3	3.67	0.033290132	1
MER34C_	24	42	0.57	0.036293875	1
MER89-int	9	2	4.50	0.036567475	1
(GGCTG)n	7	1	7.00	0.037028022	1
L1_Canid2	1	8	0.13	0.03916175	1
MER63D	14	5	2.80	0.039352319	1
MER102b	40	24	1.67	0.044708741	1
Charlie7	66	46	1.43	0.047155413	1
(CAA)n	55	37	1.49	0.04804291	1
MER45	18	8	2.25	0.049959052	1

Supplemental Table 3.

primer	primer sequence
Prdm9_e7_dog_F	5' GAGTGGCCTTACCAGGAGAA 3'
Prdm9_e7_intseq_dog_F	5' AAGGGCAAACAACGTGTGAG 3'
Prdm9_e7_intseq_dog_R	5' TTGTCATTCTACCCCCTTG 3'
Prdm9_e7_dog_R2	5' TGAGGTGGAGTGTGCAGTGGC 3'
	5'
CP_1F	TCCATCTAAGTCATCAAGAGAGTTG 3'
	5' TTCAGATTGGTATGAACACAAAA 3'
CP_1R	5' CCTGACCAAAAATTCCTCTTTC 3'
CISP_1F	3'
CISP_2F	5' AGAATTTCAAGGGCCTTTTC 3'
CISP_1R	5' CTAAGTGTGTCCTCTGGTG 3'
CISP_2R	5' TAATTTGCCTGTGTCCTCTG 3'

Supplemental Table 4.

Sample	Primers	Nested PCR primers	Annealing	Extension time	Cycles
Beagle	Prdm9_e7_dog_F + Prdm9_e7_dog_R2	NA	65-60	45	10+30
Portugese water dog	Prdm9_e7_dog_F + Prdm9_e7_dog_R2	NA	65-60	45	10+30
Bearded collie	Prdm9_e7_dog_F + Prdm9_e7_dog_R2	NA	65-60	45	10+30
Standard poodle	Prdm9_e7_dog_F + Prdm9_e7_dog_R2	NA	65-60	45	10+30
Boxer	Prdm9_e7_dog_F + Prdm9_e7_dog_R2	NA	65-60	45	10+30
Dalmatian	Prdm9_e7_dog_F + Prdm9_e7_dog_R2	NA	65-60	45	10+30
Labrador retriever	Prdm9_e7_dog_F + Prdm9_e7_dog_R2	NA	65-60	45	10+30
German shepard	Prdm9_e7_dog_F + Prdm9_e7_dog_R2	NA	65-60	45	10+30
Rough collie	Prdm9_e7_dog_F + Prdm9_e7_dog_R2	NA	65-60	45	10+30
Eurasian	Prdm9_e7_dog_F + Prdm9_e7_dog_R2	NA	65-60	45	10+30
Polish lowland sheepdog	Prdm9_e7_dog_F + Prdm9_e7_dog_R2	NA	65-60	45	10+30
Rottweiler	Prdm9_e7_dog_F + Prdm9_e7_dog_R2	NA	65-60	45	10+30
Smålandsströvare	Prdm9_e7_dog_F + Prdm9_e7_dog_R2	NA	65-60	45	10+30
Swedisk elkhound	Prdm9_e7_dog_F + Prdm9_e7_dog_R2	NA	65-60	45	10+30
Nova scotia duck tolling retriever	Prdm9_e7_dog_F + Prdm9_e7_dog_R2	NA	65-60	45	10+30
Swedish wolf (#21)	Prdm9_e7_dog_F + Prdm9_e7_dog_R2	NA	65-60	45	10+30
Swedish wolf (#34)	Prdm9_e7_dog_F + Prdm9_e7_dog_R2	NA	65-60	45	10+30
Black backed jackal	CP_1F + CP_1R	NA	55-50	180	10+30
Golden jackal	CP_1F + CP_1R	NA	55-50	180	10+30
Redfox	CP_1F + CP_1R	NA	55-50	180	10+30
African wilddog	CP_1F + CP_1R	CISP_1F + CP_1R and CISP_1F + CISP_1R	55-50	180	10+30
Bushdog	CP_1F + CP_1R	CISP_1F + CP_1R and CISP_1F + CISP_1R	55-50	180	10+30

Supplemental Table 5.

Breed	No. Samples
Belgian	
Tervuren	12
Beagle	10
Bernese	
Mountain Dog	12
Border Collie	16
Border Terrier	25
Brittany	
Spaniel	12
Cocker Spaniel	14
Dachshund	12
Doberman	
Pinscher	25
English	
Bulldog	13
Elkhound	12
English Setter	12
Eurasian	12
Finnish Spitz	12
Gordon Setter	25
Golden	
Retriever	11
Greyhound	14
German	
Shepherd	12
Greenland	
Sledge Dog	12
Irish	
Wolfhound	11
Jack Russell	
Terrier	12
Labrador	
Retriever	14
Newfoundland	25
Nova Scotia	
Duck Tolling	
Retriever	23
Rottweiler	12
Schipperke	25
Shar-Pei	11
Standard	
Poodle	12
Yorkshire	
Terrier	12
Weimaraner	26
Wolf	15
Total	471

