Explanations of coat color genetics
XXLdog

BASE COLOUR

Eumelanin

B-Locus (brown, chocolate, liver(nose))
N (no modification) > bd, bc, bs (brown)
B-Locus (rare variants)
Breeds b4: Australian Shepherd, Miniature American Shepherd
Breeds be: Lancashire Heeler
Breeds bh: Husky
N (no modification) > b4, be, bh (brown)

Genotype	Inheritance	Effect
N/N	does not inherit brown	No modification
N/bx (onefold)	can inherit brown	
N/bx (multiple)	can inherit brown	No modification or brown Eumelanin
bx/bx	inherits brown	Brown Eumelanin

Cocoa (darkbrown, dark chocolate)
Breeds cocoa: French Bulldog
N (no modification) > cocoa (cocoa)

Genotype	Inheritance	Effect
N/N	does not inherit cocoa	No modification
N/cocoa	can inherit cocoa	
cocoa/cocoa	inherits cocoa	darkbrown Eumelanin

Pheomelanin

E-Locus e1 (yellow, lemon, red, cream, apricot)
N (no modification) > e1 (yellow/red)
E-Locus (rare variants)
Breeds e2: Australian Cattle Dog
Breeds e3: Alaskan/Siberian Husky
N (no modification) > e2, e3 (yellow/red)

Genotype	Inheritance	Effect
N/N	does not inherit yellow/red	No modification
N/ex	can inherit yellow/red	
ex/ex	inherits yellow/red	Loss of dark pigment → Coat Colour is determined by pheomelanin

I-Locus (pheomelanin intensiy)
N (no modification) > i (creme/white)

Genotype	Inheritance	Effect
N/N	does not inherit light pheomelanin intensity	No modification
N/i	can inherit light pheomelanin intensity	
i/i	inherits light pheomelanin intensity	visible pheomelanin appears creme/white

Dilution

D-Locus d1 (Dilution, Colour dilution)
N (no modification) > d1 (dilute)
D-Locus (rare variants)
Breeds d2: Chow Chow, Sloughi, Thai-Ridgeback
Breeds d3: Chihuahua, Italian Greyhound, Mudi, Pumi, etc.
N (no modification) > d2, d3 (dilute)

Genotype	Inheritance	Effect
N/N	does not inherit dilution	No modification
N/dx (einmal)	can inherit dilution	
N/dx (mehrfach)	can inherit dilution	No modification or pigment agglutinates → Base Colour is diluted
dx/dx	inherits dilution	pigment agglutinates → Base Colour is diluted

WHITE AND WHITE SPOTTING

White spotting and Ticking

S-Locus (piebald, white spotting)
N (no modification) <> S (White spotting)

Genotype	Inheritance	Effect
N/N	does not inherit white spotting	No modification
N/S	can inherit white spotting	assymetric white spotting of different sizes can occur
S/S	inherits white spotting	assymetric white spotting of different sizes → White spotting, Piebald

Panda white spotting
Breeds: German Shepherd
P (Panda white sporring) > N (no modification)

Genotype	Inheritance	Effect
N/N	does not inherit Panda White Spotting	No modification
N/P	can inherit Panda white spotting	spotting pattern includes white markings on the face, ventral abdomen, feet and tip of the tail → Panda white spotting
(P/P)		lethal

T-Locus (Ticking, Roan)
! The tests includes only the TR allel !
TR (Ticking, roan) > (T (Ticking)) > N (no modification)

Genotype	Inheritance	Effect
N/N	does not inherit ticking	No modification
N/TR	can inherit ticking	
TR/TR	inherits ticking	pigmented spots in the unpigmented areas of piebald dogs

Albinism and partial albinism

C-Locus (caL, OCA2, OCA4; albino)
Breeds caL: French Bulldog, Lhasa Apso, Pekingese, Pomeranian
Breeds OCA2: German Spitz
N (no modification) > caL, OCA2, OCA4 (partial albinism)

Genotype	Inheritance	Effect
N/N	does not inherit partial albinism	
N/caL	can inherit partial albinism	No modification
N/OCA2		
caL/caL	does inherit partial albinism	upartially blocked pigment synthesis → partial albinism
OCA2/OCA2		

C-Locus (OCA4; albino)
Breeds OCA4: Bullmastiff
N (no modification) > OCA4 (partial albinism)

Genotype	Inheritance	Effect
N/N	does not inherit partial albinism	No modification
N/OCA4	can inherit partial albinism	
OCA4/OCA4	does inherit partial albinism	partially blocked pigment synthesis → partial albinism

COAT PATTERN

K-Locus

K-Locus (only KB-Allel)
KB (unform pigmentation) > ky (coat pattern)

Genotype	Inheritance	Effect
KB/KB	inherits KB	"uniform pigment distribution → solid coat colour in pigmented areas"
KB/ky	inhertits KB or ky	"uniform pigment distribution → solid coat colour in pigmented areas (in exclusion of kbr-allel)"
ky/ky	inherits ky	allows for a mixed distribution of the pigments eumelanin and pheomelanin → coat pattern according to A-Locus

K-Lokus (brindle)
KB (uniform pigmentation) > kbr (brindle) > ky (coat pattern)

Genotype	Inheritance	Effect
KB/KB	inherits KB	uniform pigment distribution → solid coat colour in pigmented areas
KB/ky	inhertits KB or ky	
KB/kbr	inhertits KB or kbr	
kbr/kbr	inherits kbr	brindle pattern above coat pattern
kbr/ky	inhertits kbr or ky	
ky/ky	inherits ky	allows for a mixed distribution of the pigments eumelanin and pheomelanin → coat pattern according to A-Locus

E-Locus

E-Locus (special colours)
E-Locus (EM, e1, e2), Expression depends on the A- and K-locus
N (no modification) > eA, eG, eH (domino, grizzle, sabel, hare pied)

Genotype	Inheritance	Effect
N/N	does not inherit the variant eX	No modification (only if e1/2/3 is N/N)
N/eX	can inherit the variant eX	
N/eX + N/eX	can inherit one of the variants eX	Domino/Sable phenotype (only phenotypically visible in combination with A- and K-Locus)
eX/eX	does inherit the variant eX	

E-Locus (melanistic mask EM)
EM (melanistic mask) > N (no modification)

Genotype	Inheritance	Effect
N/N	does not inherit EM	No modification
EM/N	can inherit EM	Melanistic mask (only phenotypically visible in combination with A- and K-Locus)
EM/EM	inherits EM	

M-Locus (merle alleles: Mh, M, Ma+, Ma, Mc+, Mc, m)

Mh (harlekin), M (merle), Ma+, Ma (atypic), Mc+, Mc (cryptic) ≥ m (non-merle)

Genotype	Inheritance	Effect
m/m	does not inherit Merle	No modification
Mx/m	can inherit Merle	depending on the exact allele, expression of different merle phenotypes
Mx/Mx	inherits Merle	Double Merle Health problems possible!

H-Locus (Harlequin)

Breeds: Great Dane

H (harlekin) > N (no modification)
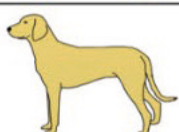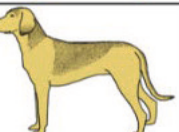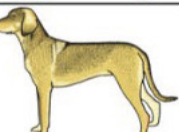
Genotype	Inheritance	Effect
N/N	does not inherit Harlequin	No modification
H/N	can inherit Harlequin	in combination with M-Locus → Harlequin coat pattern
(H/H)		lethal

A-Locus ASIP Analyse

DY (dominant yellow) > SY (shaded yellow) > AG (agouti)
> BS (black saddle) ≥ BB1-3 (black back) > a (recessive black)

Genotype	Inheritance	Effect *(sofern am K-Lokus kein KB-Allel vorliegt)*
DY/DY	inherits dominant yellow	Eumelanin almost displaced → dominant yellow phenotype
DY/SY	inherits dominant yellow or shaded yellow	
DY/AG	inherits dominant yellow or agouti	
DY/BS	inherits dominant yellow or black saddle	
DY/BB1-3	inherits dominant yellow or black back	
DY/a	inherits dominant yellow or recessive black	
SY/SY	inherits shaded yellow	dark Eumelanin in coat tips → shaded yellow
SY/AG	inherits shaded yellow or agouti	
SY/BS	inherits shaded yellow or black saddle	
SY/BB1-3	inherits shaded yellow or black back	
SY/a	inherits shaded yellow or recessive black	
AG/AG	inherits agouti	typical distribution of light and dark pigment → banded hairs of yellow and black
AG/BS	inherits agouti or black saddle	
AG/BB1-3	inherits agouti or black back	
AG/a	inherits agouti or recessive black	
BS/BS	inherits black saddle	Pheomelanin with Eumelanin sadlle
BS/BB1-3	inherits black saddle or black back	Pheomelanin mit Eumelanin back
BS/a	inherits black saddle or recessive black	Pheomelanin mit Eumelanin back
BB1-3/BB1-3	inherits black back	Eumelanin mit Pheomelanin markings („black and tan")
BB1-3/a	inherits black back or recessive black	
a/a	inherits rezessives schwarz	uniform coat colour → base colour!

Haplotypen-Allel	DY	SY	AG	BS	BB1-3	a
DY						
SY						
AG						
BS						
BB1-3						
a						

COAT STRUCTURE, COAT LENGTH, HAIRLESSNESS
Coat Structure

Furnishing (long hair/wire hair)
F (furnished) > f (unfurnished)
Improper coat
Breeds: Portuguese water dog
N (normal) > IC (improper coat)

Genotype	Inheritance	Effect
F/F = N/N	inherits Furnishing	furnished phenotype
F/f = N/IC	can inherit Furnishing	furnished phenotype
f/f = IC/IC	does not inherit Furnishing	No modification; lack of furnishing ("Improper coat")

Curly (Kraushaar)
C1: all Breeds
Breeds C2: Curly Coated Retriever, Chesapeake Bay Retriever,
Lagotto Romagnolo, Spanish Water Dog, Bichon Frise, Irish Terrier
C1, C2 (curly) > NC (no modification)

Genotype	Inheritance	Effect
NC/NC	does not inherit the trait Curly Coat	No modification
NC/C1	can inherit the variant C1 or C2	in combination with coat length and Furnishing → fine curls
NC/C2		
C1/C1	inherits the variant C1	
C2/C2	inherits the variant C2	

Haaren (Shedding)
N (non-shedding) <> SD (shedding)

Genotype	Inheritance	Effect
N/N	does not inherit Shedding	No modification
N/SD	can inherit Shedding	
SD/SD	inherits Shedding	in combination with coat length and Furnishing → increased shedding

Double Coat
A (ancient, double coat) <> D (derived, single coat)

Genotype	Inheritance	Effect
A/A	does not inherit single coat	double coat
A/D	inherits single or double coat	double coat (single coat possible)
D/D	inherits single coat	single coat

Coat lenght, Hairlessness

Coat Length I (long hair/short hair)
L (short hair) > l (long hair)
Coat Length II (long hair/short hair)
Breeds: Afghane, Akita Inu, Alaskan Malamute, Chow Chow, Eurasier,
French Bulldog, Husky, Prager Rattler, Samojede, Shar Pei, Shiba Inu

Genotype	Inheritance	Effect
L/L	does not inherit long hair	short hair
L/l (einmal)	can inherit long hair	
L/l (mehrfach)	can inherit long hair	short or long hair
l/l	inherits long hair	long hair

Hairlessness (Powderpuff)
Breeds: Chinese Crested, Mexican hairless dog, Peruvian hairless dog
H (hairlessness) > N (no modification)

Genotype	Inheritance	Effect
N/N	does not inherit hairlessness	normally haired; Powderpuff
N/H	can inherit hairlessness	hairless (residual hair possible)
(H/H)		lethal

Hairlessness
Breeds: Deerhound
N (no modification) > H (Hairlessness)

Genotype	Inheritance	Effect
N/N	does not inherit hairlessness	normally haired
N/H	can inherit hairlessness	
H/H	inherits hairlessness	hairless (residual hair possible)