The Genetic Health of the French Bulldog
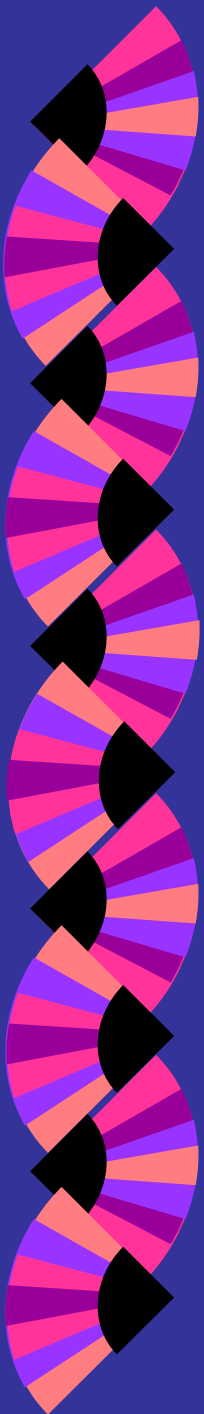

Spokane, WA - Sept. 6, 2022

Jerold S Bell, DVM
Cummings School of Veterinary Medicine
at Tufts University
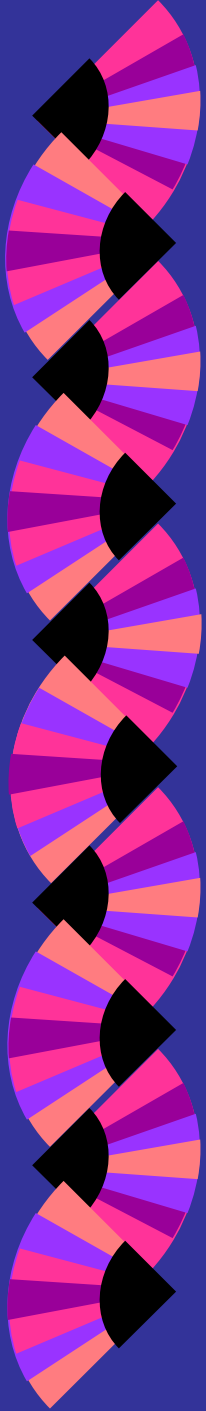
Practical Genetics for French Bulldog Breeders & Owners

Jerold S Bell, DVM
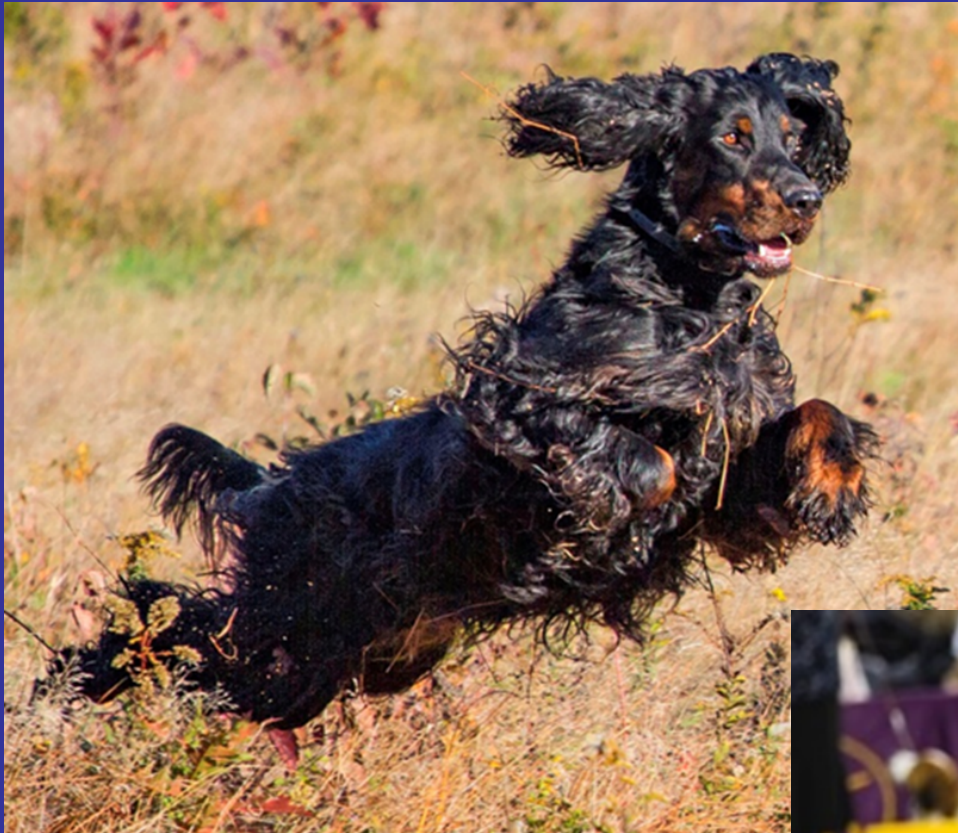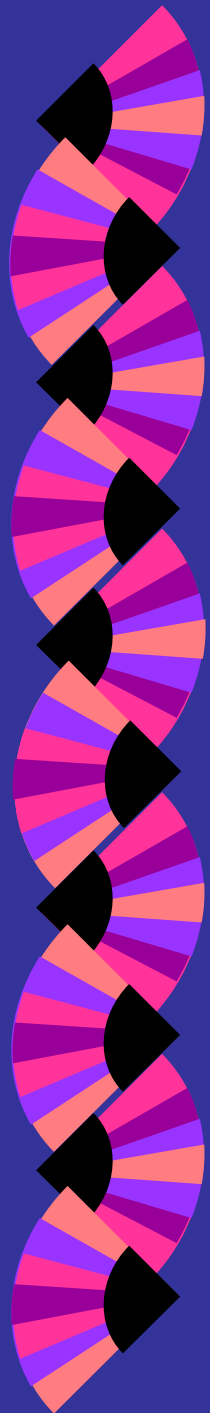Cummings School of Veterinary Medicine
at Tufts University

Freshwater

VETERINARY HOSPITAL

What is the greatest genetic health issue of French Bulldogs?

" Ivdd "
5 days ago

" IVDD "
5 days ago

" Ivdd "
5 days ago

" Breathing BOAS "
5 days ago

" Respiratory "
5 days ago

" Trachea "
5 days ago

" IVDD "
5 days ago

" Breathing "
5 days ago

" Labored breathing , allergies "
5 days ago

" Boas, spinal issues/IVDD, atopy, obesity "
5 days ago

" Ivdd "
5 days ago

" BOAS "
5 days ago

" Labored breathing "
5 days ago

" Allergies, cysternia breathing "
5 days ago

" patellas "
5 days ago

" Breathing "
5 days ago

" Breathing, disc disease, allergies "
5 days ago

" All of the above "
5 days ago

" Color, boas "
5 days ago

" Cystinuria "
5 days ago

" Eyes "
5 days ago

" The color gene "
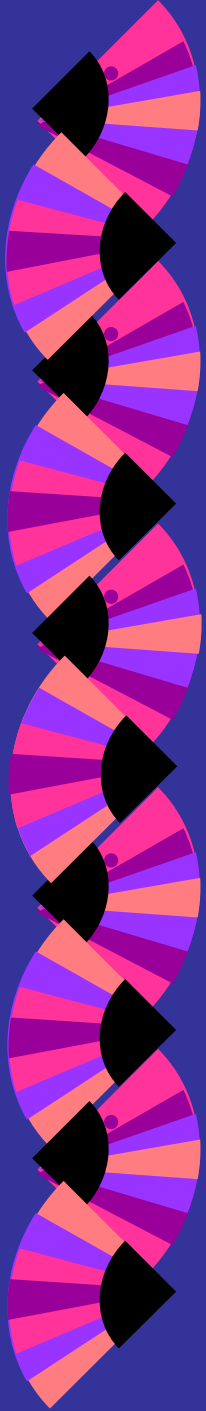5 days ago

" Breathing "
5 days ago

" Allergies, breathing "
5 days ago

" Breathing "
5 days ago

What are your questions concerning the genetic health of French Bulldogs?

" Will we ever be able to produce a frenchie that conforms to the standard but can breathe well enough? "
5 days ago

" How to avoid disease "
5 days ago

" Genetic test availability "
5 days ago

" How to obtain consistency "
5 days ago

" Boas "
5 days ago

" Breathing issues "
5 days ago

" Respiratory allergies "
5 days ago

" How to selectively breed to avoid disease "
5 days ago

" Respiratory "
5 days ago

" Breathing issues "
5 days ago

" How to obtain consistency "
5 days ago

" Best way to address allergies "
5 days ago

" Disc disease "
5 days ago

" relationship of predominant sire issue to diversity "
5 days ago

" Cystinuria dna test "
5 days ago

" Should we look at elongation of the snout? "
5 days ago

" How can ivdd be put at bay "
5 days ago

" Respiratory "
5 days ago

" Allergies, how to obtain consistency? "
5 days ago

" Should we be breeding dogs with pinched nasal cavities "
5 days ago

A large number of individuals in a breed population provides greater choices when making breeding decisions

SELECTION

With each selected trait or disorder, the proportion of the available gene pool decreases
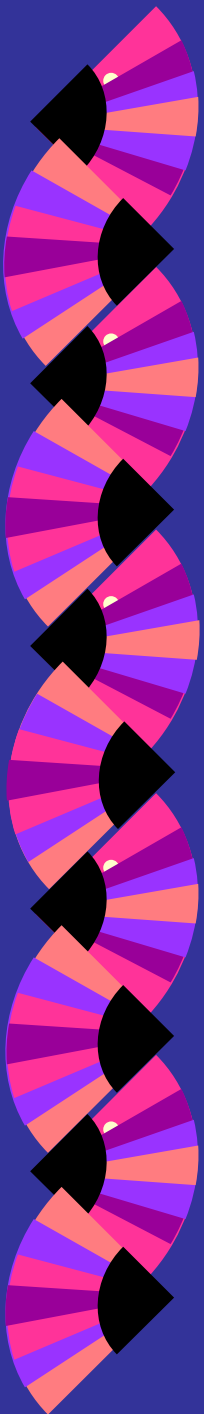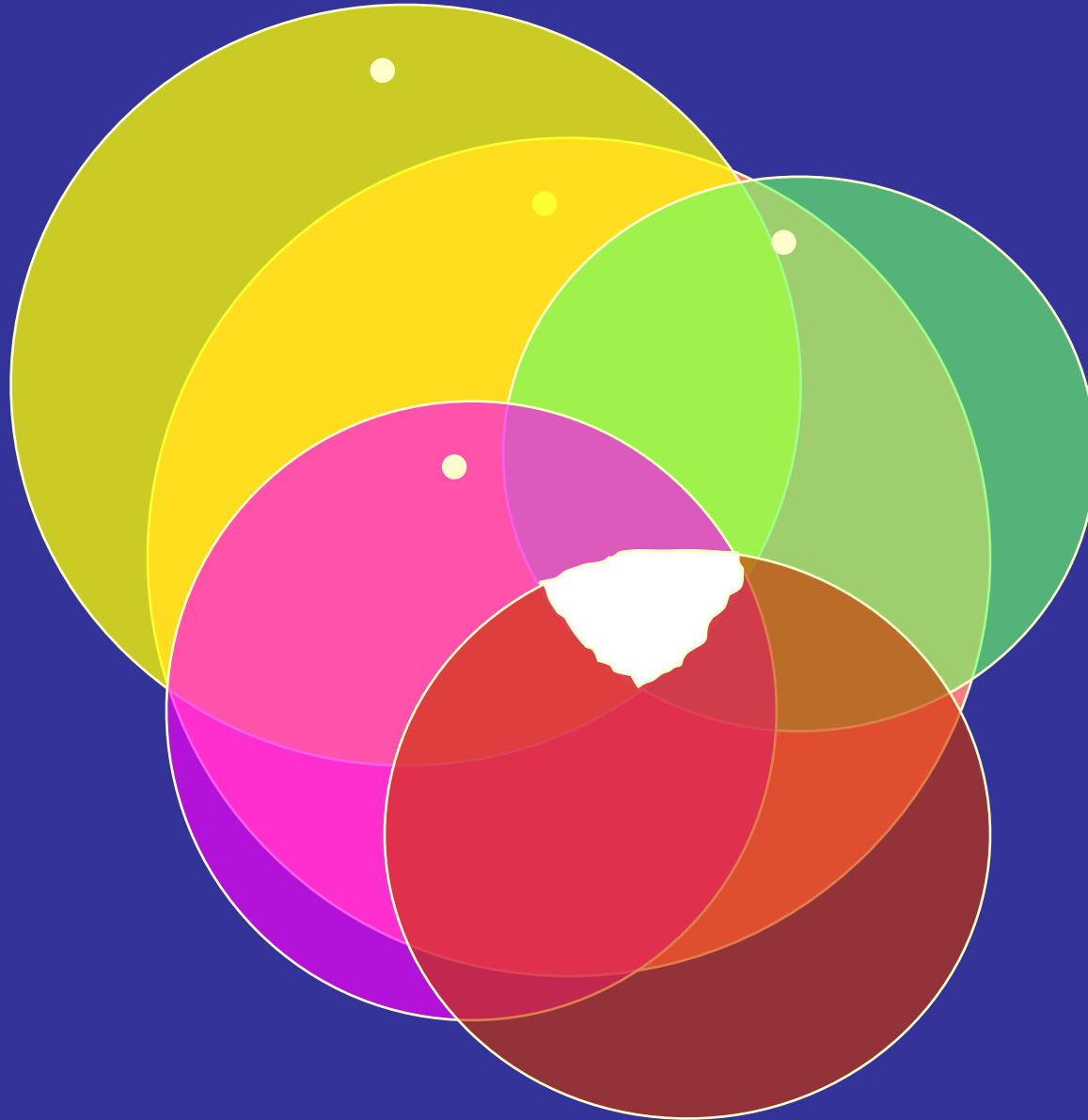
Registration Statistics of the French Bulldog

AKC Population Growth

Year	AKC Rank	# of dogs registered
2021	2	56,630
2020	2	66,458
2019	3	41,033
2018	4	32,404
2017	4	24,291
2016	6	19,118
2015	6	14,514
2014	9	11,734
2013	11	9,318
2012	14	8,473
2011	18	7,775
2010	21	7,145
2005	38	4,210
2000	71	1,513
1995	81	1,039
1990	81	632
1985	94	318
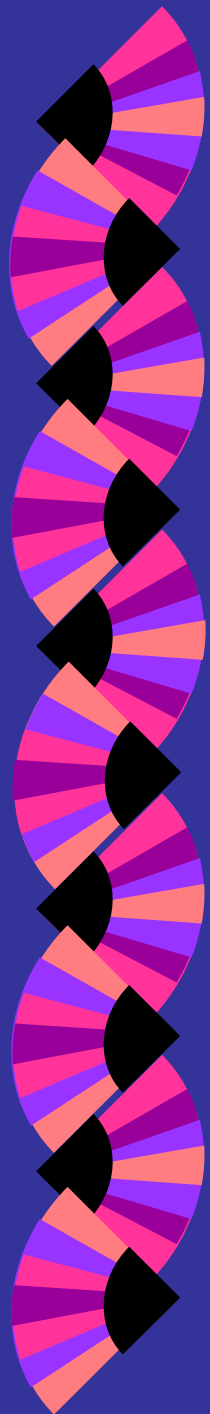
AKC Litters Registered

Year	Litters	# Pups/Litter
2021	26,904	4.8
2020	32,381	4.6
2019	22,350	4.4
2018	17,797	4.2
2017	13,554	4.2
2016	10,508	4.1
2015	7,899	4.0
2014	6,497	3.8
2013	5,279	3.8
2012	4,828	3.7
2011	4,445	3.6
2010	4,282	3.7
2005	?	
2000	729	
1995	452	
1990	303	
1985	128	

Percent of all registered dogs bred (2010-2016)

Top 1/3 of AKC breeds by population size
Average = 10.4%

French Bulldog
= 20.4%
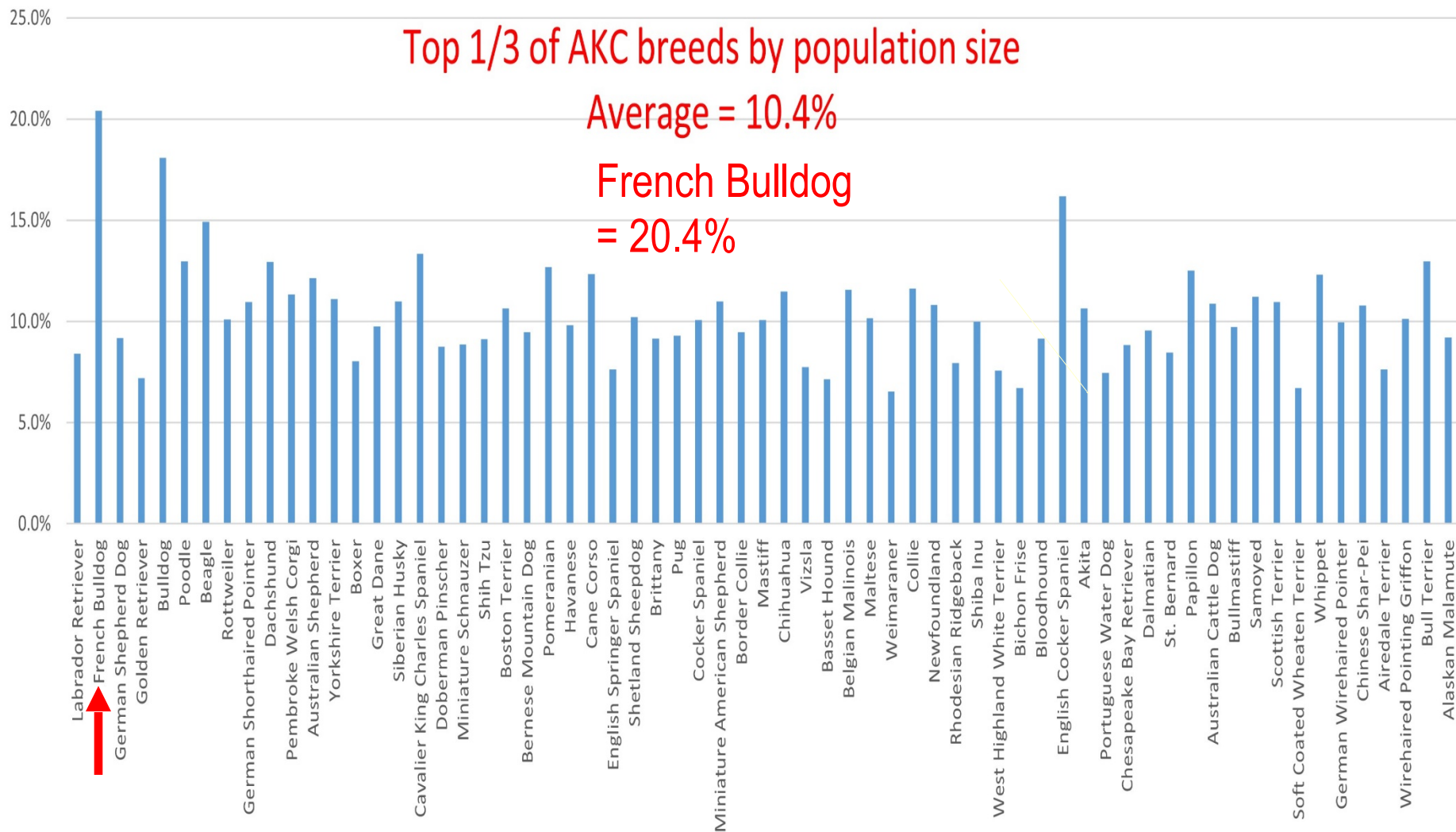
AKC French Bulldogs Bred

% of Each Year's Litter Complement that have been Bred (to date)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
% Complement Bred (to date)	17.0%	16.1%	16.3%	19.2%	20.7%	22.3%	23.3%	23.8%	22.6%	21.5%	17.0%	4.7%

Litters

	2016	2017	2018	2019	2020
	3%	3%	2%	1%	1%

Litters (PC Members)   Litters (Non-Members)
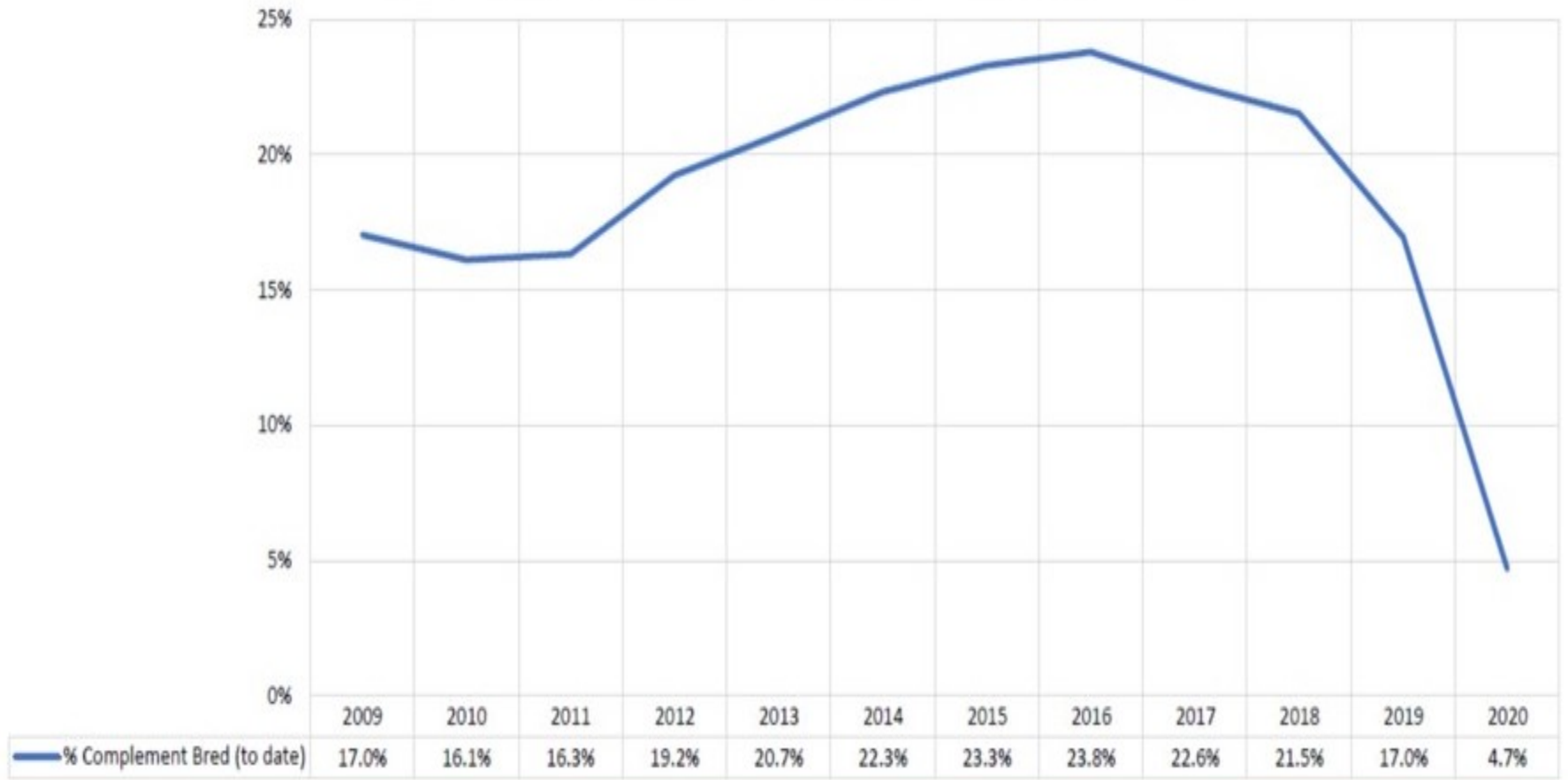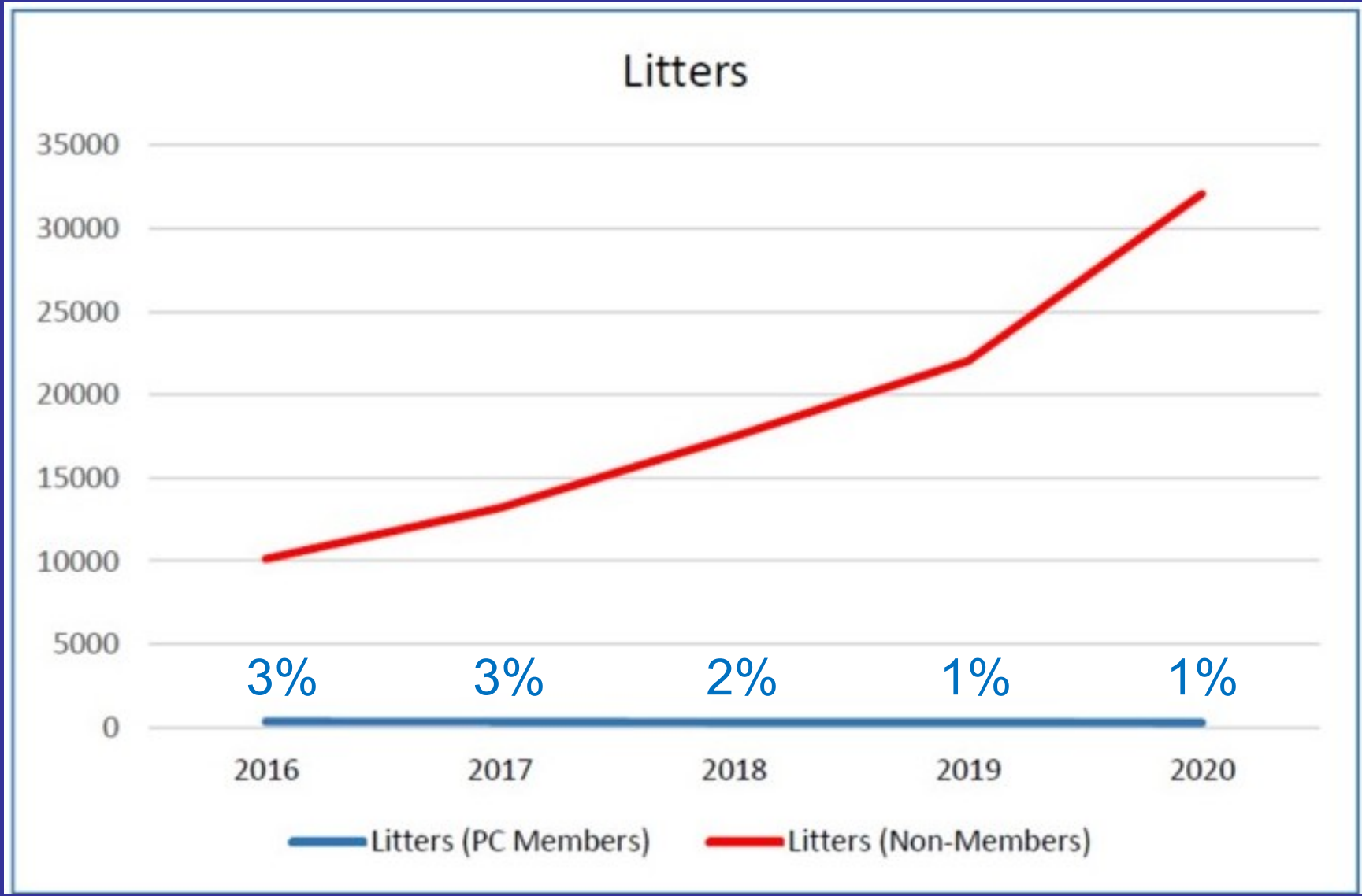
The Ins and Outs of Pedigree Analysis, Genetic Diversity, and Genetic Disease Control

http://siriusdog.com/bell-pedigree-analysis-genetic-diversity
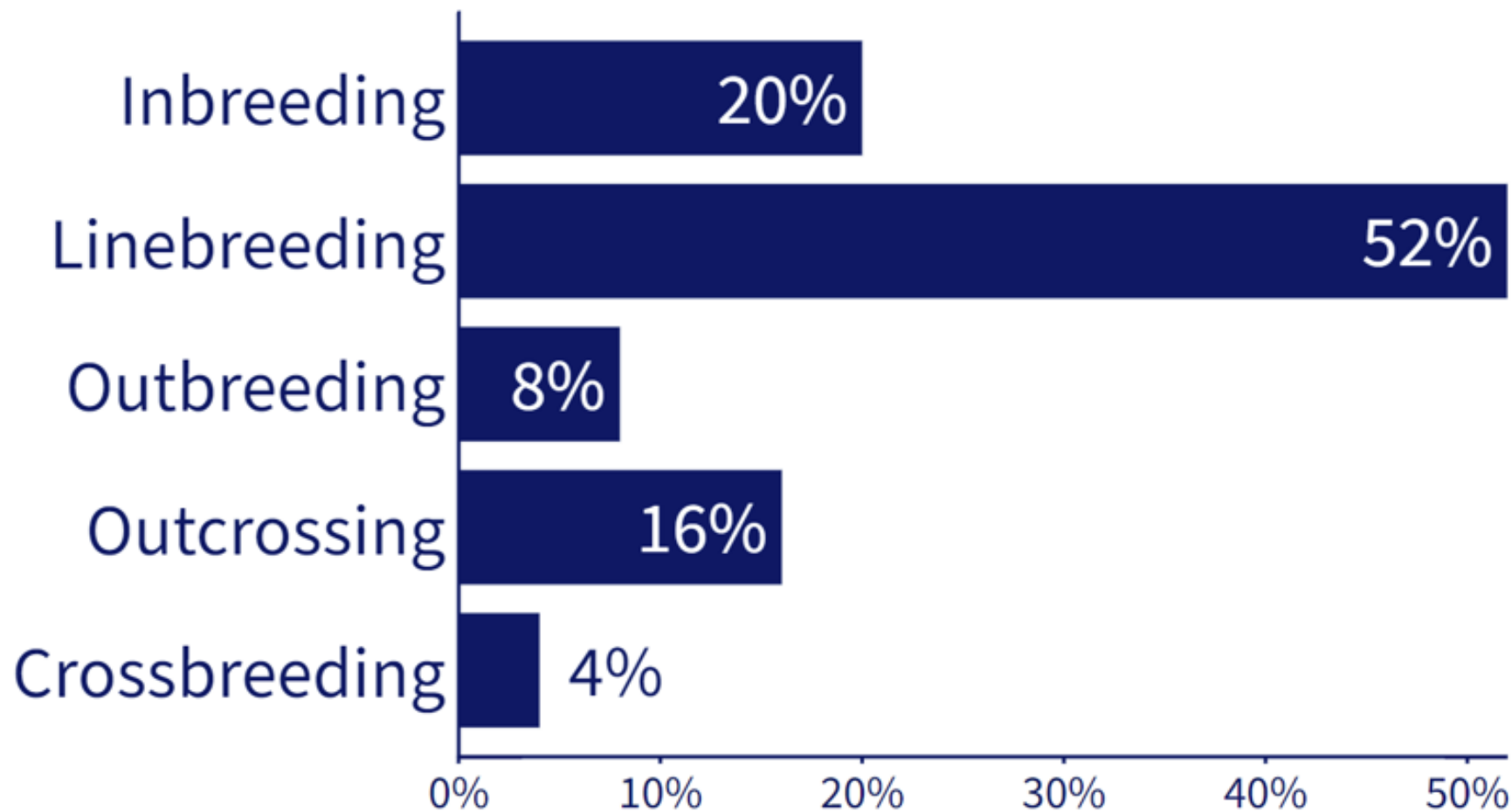
Types of Matings

- **Inbreeding**: Breeding closely related dogs.
- **Linebreeding**: Less intense form of inbreeding. Concentrating the genes of a particular ancestor.
- **Outbreeding**: Breeding dogs less related than the average of the population.
- **Crossbreeding**: Breeding two different breeds together.

Pure-bred

Designer breed

Random-bred
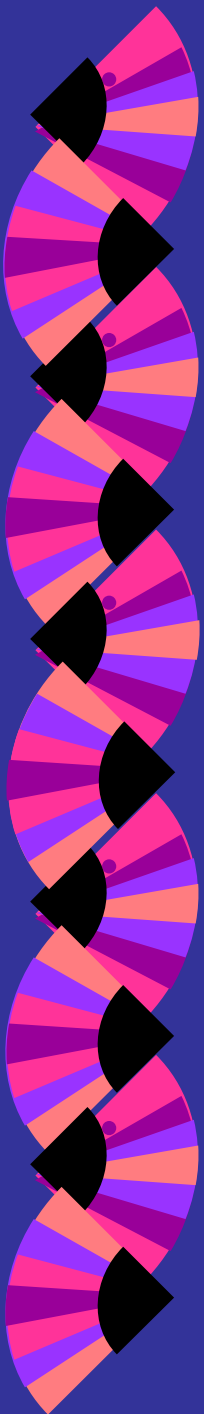
Inbreeding Coefficient
(Wright's Coefficient = Fx)

- The proportion of all variable gene pairs that are likely to be homozygous due to inheritance from ancestors *common* to the sire and dam.

- The probability of an individual being homozygous at a given gene pair for a gene received from an ancestor *common* to the sire and dam.

Relationship Coefficient

- A measurement of the probable genetic likeness between the individual and a particular ancestor

- The probable percentage of genes the individual and the ancestor have in common from descent

- Can be approximated by % blood calculation

AKC French Bulldog
Inbreeding Coefficients Over Time
(495,480 dogs)

Period	Count	Mean # Gen	Mean 5 Gen IC	Mean 10 Gen	Mean All Gen IC	Mean # Unique Anc
1960-9	59	3.1				5
1970-9	1,572	6.7	13.2%	13.1%	13.1%	23
1980-9	3,407	12.3	8.9%	10.2%	10.2%	101
1990-9	10,540	17.2	6.8%	11.1%	11.1%	240
2000-9	46,093	23.1	4.1%	7.5%	8.1%	600
2010-9	218,442	30.5	3.7%	3.9%	4.9%	1,497
2020-2	184,573	34.4	3.0%	3.4%	3.7%	2,204

French Bulldog Inbreeding Coefficients Over Time

AKC French Bulldogs

Inbreeding Coefficient

15.0%
10.0%
5.0%
0.0%

Year of Birth

1970-9   1980-9   1990-9   2000-9   2010-9   2020-2

■ 5 Gen IC   ■ 10 Gen IC   ■ All Gen IC
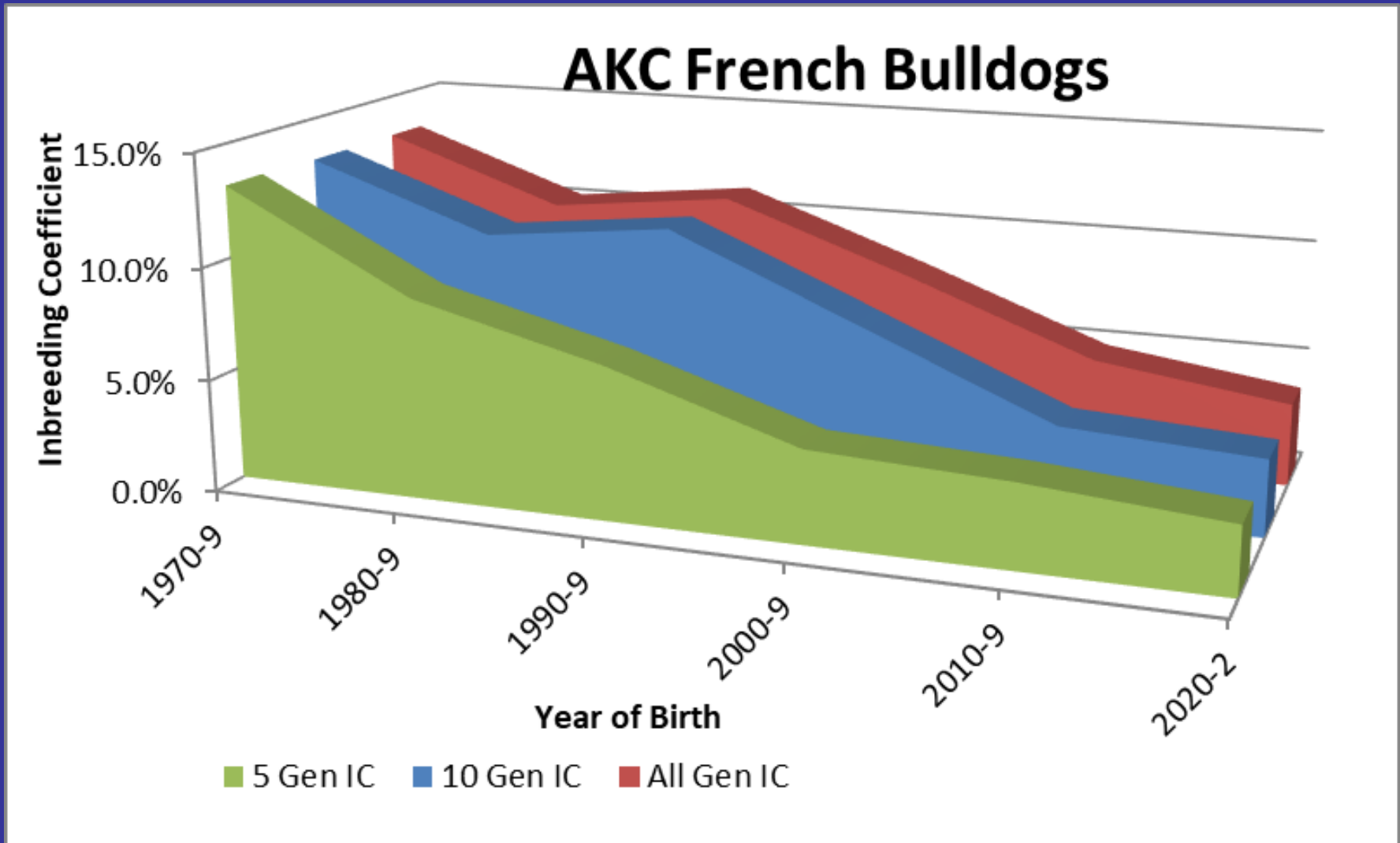
Breed Inbreeding Coefficients

Breed	Period	10 gen. coefficient
American Cocker Spaniel	1980-1999	10.49 +/- 7.33
Bichon Frise	1990-2004	19.55 +/- 7.68
Bernese Mountain Dog	1990-1999	11.32 +/- 4.50
Borzoi	1990-1999	10.48 +/- 8.85
Bouvier des Flandres	1990-1999	13.96 +/- 5.92
Briard	1976-1993	15.18 +/- 7.66
Bull Terrier	1990-1999	19.01 +/- 6.23
Cavalier King Charles Sp.	1990-1999	13.17 +/- 5.83
English Pointer	1990-2005	17.00 +/- 8.07
German Shorthaired Pointer	1990-1995	11.12 +/- 8.50
Great Pyrenees	1985-1990	17.76 +/- 9.17
Irish Setter	1990-2002	15.81 +/- 5.84
Mastiff	1990-1999	11.59 +/- 6.57
Norfolk Terrier	1990-2000	29.79 +/- 7.32
Nova Scotia Duck Tolling Ret.	1990-1999	27.17 +/- 4.48
Poodle, Miniature	1980-2000	16.50 +/- 7.86
Poodle, Standard	1980-2000	16.25 +/- 7.77
Rhodesian Ridgeback	1990-1999	15.91 +/- 6.15
Samoyed	1990-1999	9.94 +/- 7.64
Siberian Husky	1990-2000	15.47 +/- 6.99
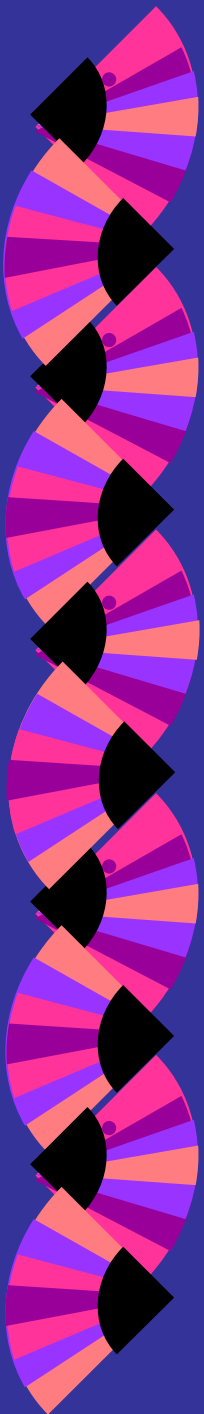
Embark French Bulldog Molecular COI Analysis
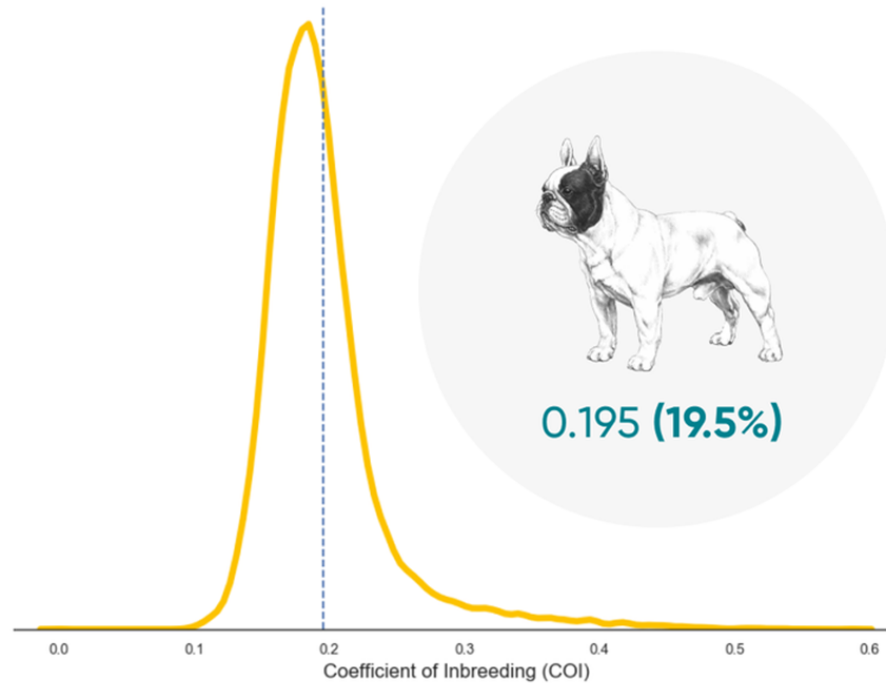
Influential AKC French Bulldog Ancestors

Dog	Sex	DOB	1960's
Besing Vive Le Prince Of Laurelwood	M		10%
Glenthorn Maxiboi Of Laurelwood	M	9/29/1966	8%
Terrette's Tourbillon D'Gamin	M	12/26/1963	8%
Miller's Godefroy De Bouillon	M	11/14/1966	5%
Terrette's Fils De Bijou	M		5%
Laurelwood Delphine	F		5%
Hover's Princess Snowflake	F		4%
Laurelwood Arabelle	F		4%
Hampton's Petite Cherie	F		4%
Lavender's Crame De Cacao	F	1/24/1967	3%
Chaseholme Mr Chips	M	7/1/1967	3%
Regina Du Cro Marin	F	7/18/1968	3%
Haab's Jo Jo	M	6/11/1964	3%
Terrette's Renee Brume De Miel	F		3%
Schmidt's La Belle Otero	F		3%
Bonlitz Edwardbear	M		3%
Bonnevarie Candytuft Of Chaseholme	F		3%
Pomeroy's La Countess Cinde	F		3%
Kittel's De Bonnes Nouvelles	F		3%
Berryhill's Sauve Oui Peut	F		3%
Hampton's Pierrot	M		3%
Hampton's Desiree	F		3%

Influential AKC French Bulldog Ancestors

Dog	Sex	DOB	1960's	1970's
Besing Vive Le Prince Of Laurelwood	M		10%	6%
Glenthorn Maxiboi Of Laurelwood	M	9/29/1966	8%	6%
Terrette's Tourbillon D'Gamin	M	12/26/1963	8%	18%
Miller's Godefroy De Bouillon	M	11/14/1966	5%	
Terrette's Fils De Bijou	M		5%	3%
Laurelwood Delphine	F		5%	4%
Hover's Princess Snowflake	F		4%	3%
Laurelwood Arabelle	F		4%	
Hampton's Petite Cherie	F		4%	9%
Lavender's Crame De Cacao	F	1/24/1967	3%	
Chaseholme Mr Chips	M	7/1/1967	3%	
Regina Du Cro Marin	F	7/18/1968	3%	3%
Haab's Jo Jo	M	6/11/1964	3%	
Terrette's Renee Brume De Miel	F		3%	4%
Schmidt's La Belle Otero	F		3%	
Bonlitz Edwardbear	M		3%	
Bonnevarie Candytuft Of Chaseholme	F		3%	
Pomeroy's La Countess Cinde	F		3%	
Kittel's De Bonnes Nouvelles	F		3%	
Berryhill's Sauve Oui Peut	F		3%	3%
Hampton's Pierrot	M		3%	
Hampton's Desiree	F		3%	
Terrette's Chef D'Oeuvre	M			5%
Terrette's Enchantress	F			5%
Laurelwood Delphine	F			4%
Koch's Bobo	M	9/19/1968		4%
Terrette's Polar De La Neige	M	9/24/1967		4%
Smiths Bon Mot	M	9/4/1969		4%

Influential AKC French Bulldog Ancestors

Dog	Sex	DOB	1960's	1970's	1980's
Besing Vive Le Prince Of Laurelwood	M		10%	6%	3%
Glenthorn Maxiboi Of Laurelwood	M	9/29/1966	8%	6%	
Terrette's Tourbillon D'Gamin	M	12/26/1963	8%	18%	20%
Terrette's Fils De Bijou	M		5%	3%	3%
Laurelwood Delphine	F		5%	4%	
Hover's Princess Snowflake	F		4%	3%	3%
Hampton's Petite Cherie	F		4%	9%	10%
Regina Du Cro Marin	F	7/18/1968	3%	3%	
Terrette's Renee Brume De Miel	F		3%	4%	3%
Berryhill's Sauve Oui Peut	F		3%	3%	3%
Terrette's Chef D'Oeuvre	M			5%	5%
Terrette's Enchantress	F			5%	5%
Laurelwood Delphine	F			4%	
Koch's Bobo	M	9/19/1968		4%	
Terrette's Polar De La Neige	M	9/24/1967		4%	3%
Smiths Bon Mot	M	9/4/1969		4%	4%
Burlington Berti Of Boristi	M	2/18/1973			8%
Tommyville Tintoretto	M	6/17/1977			5%
Bitter Sweet Of Boristi	F				5%
La Forest's Cream Puff	M	5/6/1971			4%
Fairmont's Radar Ahead	M	2/2/1979			4%
Hampton's Poupee D'Or	F				3%
Tommyville Troglodyte Of Hernhill	M				3%

Influential AKC French Bulldog Ancestors

Dog	Sex	DOB	1960's	1970's	1980's	1990's
Besing Vive Le Prince Of Laurelwood	M		10%	6%	3%	
Terrette's Tourbillon D'Gamin	M	12/26/1963	8%	18%	20%	20%
Terrette's Fils De Bijou	M		5%	3%	3%	4%
Hover's Princess Snowflake	F		4%	3%	3%	3%
Hampton's Petite Cherie	F		4%	9%	10%	10%
Terrette's Renee Brume De Miel	F		3%	4%	3%	4%
Berryhill's Sauve Oui Peut	F		3%	3%	3%	3%
Terrette's Chef D'Oeuvre	M			5%	5%	5%
Terrette's Enchantress	F			5%	5%	5%
Terrette's Polar De La Neige	M	9/24/1967		4%	3%	
Smiths Bon Mot	M	9/4/1969		4%	4%	
Burlington Berti Of Boristi	M	2/18/1973			8%	8%
Tommyville Tintoretto	M	6/17/1977			5%	5%
Bitter Sweet Of Boristi	F				5%	5%
La Forest's Cream Puff	M	5/6/1971			4%	4%
Fairmont's Radar Ahead	M	2/2/1979			4%	6%
Hampton's Poupee D'Or	F				3%	3%
Tommyville Troglodyte Of Hernhill	M				3%	
Adams' Unique Physique	M	11/21/1979				5%
Scobey's Maurice Bon Homme	M	6/1/1975				4%
Cox's Petite Babette	F	11/21/1974				3%
Balihai's Quad	M	9/25/1974				3%

Influential AKC French Bulldog Ancestors

Dog	Sex	DOB	1960's	1970's	1980's	1990's	2000's
Terrette's Tourbillon D'Gamin	M	12/26/1963	8%	18%	20%	20%	17%
Terrette's Fils De Bijou	M		5%	3%	3%	4%	3%
Hover's Princess Snowflake	F		4%	3%	3%	3%	
Hampton's Petite Cherie	F		4%	9%	10%	10%	8%
Terrette's Renee Brume De Miel	F		3%	4%	3%	4%	3%
Berryhill's Sauve Oui Peut	F		3%	3%	3%	3%	
Terrette's Chef D'Oeuvre	M			5%	5%	5%	4%
Terrette's Enchantress	F			5%	5%	5%	4%
Burlington Berti Of Boristi	M	2/18/1973			8%	8%	6%
Tommyville Tintoretto	M	6/17/1977			5%	5%	4%
Bitter Sweet Of Boristi	F				5%	5%	4%
La Forest's Cream Puff	M	5/6/1971			4%	4%	3%
Fairmont's Radar Ahead	M	2/2/1979			4%	6%	5%
Hampton's Poupee D'Or	F				3%	3%	
Adams' Unique Physique	M	11/21/1979				5%	
Scobey's Maurice Bon Homme	M	6/1/1975				4%	
Cox's Petite Babette	F	11/21/1974				3%	
Balihai's Quad	M	9/25/1974				3%	
Cox's Good Time Ace In The Hole	M	3/23/1984					5%

Influential AKC French Bulldog Ancestors

Dog	Sex	DOB	1960's	1970's	1980's	1990's	2000's	2010's
Terrette's Tourbillon D'Gamin	M	12/26/1963	8%	18%	20%	20%	17%	10%
Terrette's Fils De Bijou	M		5%	3%	3%	4%	3%	
Hampton's Petite Cherie	F		4%	9%	10%	10%	8%	5%
Terrette's Renee Brume De Miel	F		3%	4%	3%	4%	3%	
Terrette's Chef D'Oeuvre	M			5%	5%	5%	4%	
Terrette's Enchantress	F			5%	5%	5%	4%	
Burlington Berti Of Boristi	M	2/18/1973			8%	8%	6%	3%
Tommyville Tintoretto	M	6/17/1977			5%	5%	4%	
Bitter Sweet Of Boristi	F				5%	5%	4%	
La Forest's Cream Puff	M	5/6/1971			4%	4%	3%	
Fairmont's Radar Ahead	M	2/2/1979			4%	6%	5%	
Cox's Good Time Ace In The Hole	M	3/23/1984					5%	
Belboulecan Du Champagne Mondo	M							5%
Truhali Skywalker At Glenlee	M							3%

Influential AKC French Bulldog Ancestors

Dog	Sex	DOB	1960's	1970's	1980's	1990's	2000's	2010's	2020's
Terrette's Tourbillon D'Gamin	M	12/26/1963	8%	18%	20%	20%	17%	10%	6%
Hampton's Petite Cherie	F		4%	9%	10%	10%	8%	5%	3%
Burlington Berti Of Boristi	M	2/18/1973			8%	8%	6%	3%	
Belboulecan Du Champagne Mondo	M							5%	5%
Truhali Skywalker At Glenlee	M							3%	4%
Kolumb Iz Russkoi Skazki	M								4%

Pedigree of Fox Canyon*s I Won The War At Goldshield

Goldshield*s Catch A Dream De La Rive Gauche	Bandog*s Mojo De La Rive Gauche	Bandog Bayou*s The Warrior	Bandog*s Feel The Magic	Gardien Bandog Yankee Doodle	Coxs Goodtime Polar Bear / Gardien*s Luminates The Ring
				Bandog*s Jump For Joy	Coxs Goodtime Polar Bear / Bandog*s A Million Wishes
			Bandog Bayou*s Creme Brulee	Bandog Gardien Capedcrusader	Cox*s Goodtime I'm Charlie Too / Bandog*s Gardien Angel
				Bandog*s Bound For Glory	Bandog*s One In A Million / Fourstar Bandogs Pattys Puddin
		Bandog*s Never More	Gardien Bandog Yankee Doodle	Coxs Goodtime Polar Bear	Cox*s Goodtime Jake Of Jock / Cox*s Goodtime Isabella
				Gardien*s Luminates The Ring	Bandog*s One In A Million / Nb*s Labelle Dentelle De Peche
			Bandog*s Jump For Joy	Coxs Goodtime Polar Bear	Cox*s Goodtime Jake Of Jock / Cox*s Goodtime Isabella
				Bandog*s A Million Wishes	Bandog*s One In A Million / Bandog*s Legend Of KT
	Robobull Goldshield Justadream	Shore Lookin* Good	Petit Motif Be On The Lookout	Motif*s Solid As A Rock	Beaulad Jasper Le Noire / Beaulad Coco Chanel
				Petit Choux Pick Me-Pick Me!	Petty Thief Of My Heart / Esenei*s Midnight Skye
			Shore Tres Bon Chien Bettyboop	Fairytale*s He*s A Keeper	Pettybulls Achilles / Esenei*s Felony Luv Snatcher
				Tres Bon Chien For Shore	Ticks Cool Hand Luke / Tebull*s Arctic Front Tres Bon Chie
		Robobull Fabelhaft Fantheflame	Robobull Fabelhaft Inferno	Justamr*s Golden Budda *Of*haft	VI Du Lac Starhaven*s Dante / Justamere*s Golden Delicious
				Xclusive De La Parure	Urie De La Parure / Unhara De La Parure
			Escapade De La Parure	Texas Boy V. Fivelzight	Armani De La Parure / Suzie Que V. Fivelzight
				Cacharel De La Parure	Zenith De La Parure / Isabella Le Beautete
Fox Canyon*s Paradigm Zoe Saldana	Highwood*s Big Shot	Robobull Fabelhaft Ringoffire	Robobull Fabelhaft Inferno	Justamr*s Golden Budda *Of*haft	VI Du Lac Starhaven*s Dante / Justamere*s Golden Delicious
				Xclusive De La Parure	Urie De La Parure / Unhara De La Parure
			Fabelhaft Eybul Bambino	Robobull Fabelhaft Xcelsior	Oomepatabull*s Ready To Rumble / Xclusive De La Parure
				Eybul Ma*s Favrit Valentine	VI Du Lac Starhaven*s Dante / Jaes Truly Scrumptious
		Highwood*s Geisha Girl	Stephlyn*s Absolutely Fabulous	Stephlyn*s Wild Wild West	Blazins* Ironside Perry Of NRW / Shadetree Stephlyn Getn jiggyw*it
				Exemplr Punch It Margaret	Monroe*s Re-Marc-A-Bull Matt / Exemplr Addicted To Love
			Holmac*s Haena Girl	Peja*s Jacque Cousteau	C And D*s Monsieur La Mon.F*s / Kenmar*s Miss Big Shot
				Suzie Q	Mon Petit Chou Millionaire Nic / Nb*s Rouge Un Tout Petite Peu
	Fox Canyon Imperiale Ironwood*s Billie Holiday	Imperiale Bella Ridge*s Ryan Phillippe Of Ironwood	Fabelhaft Too Hot To Handle	Robobull Fabelhaft Inferno	Justamr*s Golden Budda *Of*haft / Xclusive De La Parure
				Fabelhaft Flower Power	Eltorro*s Roch Voisine / Firesides* Snow Belle
			Imperiale*s Claudette Colbert	Imperiales Ellijah Wood	Kishniga*s Imperiale Vicomte / Imperiale*s Marilyn Monroe
				Karendon Imperiale Grace Kelly	Kishniga*s Imperiale Vicomte / The Diva At Karendon
		Imperiale Fox Canyon Hattie Mcdaniel	Imperiales Ellijah Wood	Kishniga*s Imperiale Vicomte	Belhoulean Histoire De Ma Vie / Kishniga Showbiz Aurora
				Imperiale*s Marilyn Monroe	Justamere*s Noah At Karendon / Belhoulean Imp Vicomtesse
			Kondorvolgyi Furby	Azuro Du Chien-Iache	Sauron Dell*Oldomyo Lengai / Lilien Du Chien-Iache
				Tass Szepe Frizbi	385039 / 381020

5 gen IC= 1.3%   10 gen IC= 4.1%   All gen IC= 5.7%

Pedigree Analysis for Fox Canyon's I Won The War At Goldshield   I.C.= 1.3%/4.1%/5.7%

Linebred Ancestors	% Blood	1st Gen.	#Times
Robobull Fabelhaft Inferno	15.6%	4	3
Terrette's Tourbillion D'Gamin	14.3%	11	13,923
Cox's Goodtime Polar Bear	10.2%	5	5
Xclusive De La Parure	9.4%	5	4
Bandog's One In A Million	9.0%	6	9
Hampton's Chevalier	8.8%	11	2,939
Fairmont's Heart To Beat	8.5%	9	349
Jimmy Lee's Sparkle	8.1%	10	983
Kishniga's Benvenuto	7.7%	7	19
Cox's Good Time Ace In The Hole	6.9%	8	76
VI Du Lac Starhaven's Dante	6.6%	6	6
Jimmy Lee's Bandolaro of Ono	6.1%	10	505
Justamere's Golden Delicious	5.9%	6	6
Adams' Unique Physique	5.8%	9	133

Pedigree of Empire N Bandog*s Walk on Water

				Cox*s Goodtime Jock Of Bridges
			Coxs Goodtime Jake Of Jock	Cox*s Good Time Petite Minnie
		Coxs Goodtime Polar Bear		Enstrom*s El*bee Great
			Cox*s Goodtime Isabella	Coxs Goodtime Charlie*s Angel
	Gardien Bandog Yankee Doodle			K N* D Foxy Joe Of Cox*s Goodtime
			Bandog*s One In A Million	Bandog*s Joy To The World
		Gardien*s Luminates The Ring		Joy*s Das Mein Meesterwerk NB
Bandog*s Feel The Magic			Nb*s Labelle Dentelle De Peche	Balihai Chantilly Lace Of NB
				Cox*s Goodtime Jock Of Bridges
			Coxs Goodtime Jake Of Jock	Coxs Good Time Petite Minnie
		Coxs Goodtime Polar Bear		Enstrom*s El*bee Great
	Bandog*s Jump For Joy		Cox*s Goodtime Isabella	Coxs Goodtime Charlie*s Angel
				K N* D Foxy Joe Of Cox*s Goodtime
			Bandog*s One In A Million	Bandog*s Joy To The World
		Bandog*s A Million Wishes		Cox*s Goodtime Pierre Of K and D
			Bandog*s Legend Of KT	Kt*s Southern Belle

Bandog*s Stand Up And Cheer

			Bandog*s Feel The Magic	Gardien Bandog Yankee Doodle / Bandog*s Jump For Joy
Bandog N TX-STAR*s Come To The Garden	Hilsman Bandog Holy Moses !		Hilsman*s Butterbean	Hilsman*s Octavian / Hilsman*s Bit O* Honey
	A*Vigdors Irrealite De Jean Cocteau At Bandog*S		Leiboll*s Alfa-Alfa	Daulokke*s Sedeux Le Superbe / Leiboll*s Version 2
			D*Avigdors Emotion	Daulokke*s Uzo Le Chamour / A*Vigdors Trova

Bandog Bayou*s Brooklyn

		Bayhill August Nash	Bayhill Sebastiano	Jaguar*s Chewbaca Jamel / Starhaven*s Tarot At Bayhill
Bandog Bayou*s Betty Boop			Bayhill Let Them Eat Cake	Stephlyn*s Absolutely Fabulous / Starhaven*s Tarot At Bayhill
		Bandog Bayou*s Southern Belle	Bandog*s Feel The Magic	Gardien Bandog Yankee Doodle / Bandog*s Jump For Joy
			Bandog Bayou*s Creme Brulee	Bandog Gardien Capedcrusader / Bandog*s Bound For Glory

Bandog*s Stand Up And Cheer

(left column spanning: **Bandog*s Stand Up And Cheer** over Bandog*s Feel The Magic and Bandog Bayou*s Brooklyn)

Empire N Bandogs Versace On The Floor

			Bandog*s Mojo De La Rive Gauche	Bandog Bayou*s The Warrior / Bandog*s Never More
Bandog*s A League Of His Own At Tx-Star	Bandog*s Major League Homerun at TX Star		Major League Rumor Has It	Daystars Highlander Fanciful / Daystar*s Major League Sensation
	Bandog*s Now Ucit At Tx Star		A*Vigdors Code D*Honneur Of Bandog*S	Beau Mystique*s Yankee Doodle / Boaguay A*Vigdors Norma
			Bandog*s Trick Or Treat	Bandog*s Feel The Magic / Bandog*s Joy Rider

Bandog N Tx-Star Its Not Easy Being Green @ 2stars

		2 Stars One Tough Hombre	Soloventures Matinee Idol	Sands Capt. America Of Soloventure / Winsomes Casseopea Of Kobi
2 Stars Girl On Fire			2stars Vindemiola Dulce Porcia Gratias	Chelons Me And Mister Magoo / Porcia Puella Pro Brute D*Mckee
		2 Stars Spirit Of Liberty	Soloventures Matinee Idol	Sands Capt. America Of Soloventure / Winsomes Casseopea Of Kobi
			2stars Vindemiola Dulce Porcia Gratias	Chelons Me And Mister Magoo / Porcia Puella Pro Brute D*Mckee

Bandog Empires Cinderella

			Bandog*s Feel The Magic	Gardien Bandog Yankee Doodle / Bandog*s Jump For Joy
Bandog N TX-STAR*s Come To The Garden	Hilsman Bandog Holy Moses !		Hilsman*s Butterbean	Hilsman*s Octavian / Hilsman*s Bit O* Honey
	A*Vigdors Irrealite De Jean Cocteau At Bandog*S		Leiboll*s Alfa-Alfa	Daulokke*s Sedeux Le Superbe / Leiboll*s Version 2
			D*Avigdors Emotion	Daulokke*s Uzo Le Chamour / A*Vigdors Trova

		Bandog*s Major League Homerun at TX Star	Bandog*s Mojo De La Rive Gauche	Bandog Bayou*s The Warrior / Bandog*s Never More
Bandog*s A League Of Her Own At Tx-Star			Major League Rumor Has It	Daystars Highlander Fanciful / Daystar*s Major League Sensation
		Bandog*s Now Ucit At Tx Star	A*Vigdors Code D*Honneur Of Bandog*S	Beau Mystique*s Yankee Doodle / Boaguay A*Vigdors Norma
			Bandog*s Trick Or Treat	Bandog*s Feel The Magic / Bandog*s Joy Rider

Empire N Bandogs Versace On The Floor

5 gen IC=7.4%   10 gen IC=14.8% All gen IC=17.4%

Pedigree Analysis for Empire N Bandog's Walk On Water I.C.= 7.4%/14.8%/17.4%

Linebred Ancestors	% Blood	1st Gen.	#Times
Bandog's Feel The Magic	39.1%	2	8
Bandog N TX-STAR's Come To The Garden	25.0%	3	2
Cox's Goodtime Polar Bear	23.3%	4	32
Bandog's Jump For Joy	22.7%	3	12
Gardien Bandog Yankee Doodle	21.1%	3	10
Terrette's Tourbillion D'Gamin	19.2%	10	53,685
Bandog's One In A Million	15.2%	5	64
Cox's Goodtime Jake of Jock	12.6%	5	45
Fairmont's Heart To Beat	12.2%	8	1,542
Cox's Good Time Isabella	12.0%	5	43
Hampton's Chevalier	11.7%	10	11,556
Cox's Good Time Ace In The Hole	11.7%	7	432
Bandog's A Million Wishes	11.3%	4	12
Jimmy Lee's Sparkle	11.0%	9	4,004
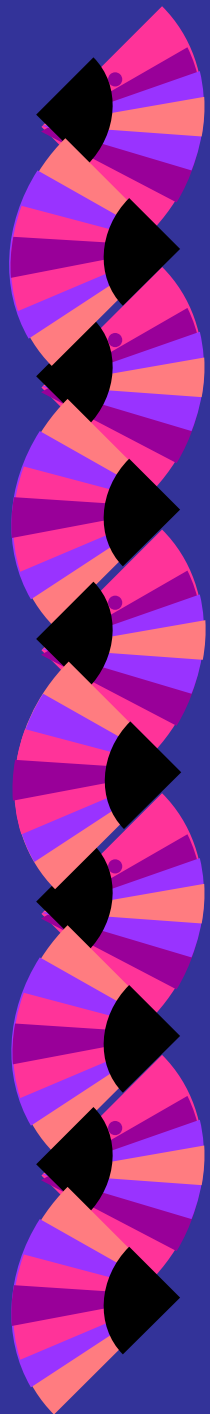
Pedigree of Miranda*s Lucky

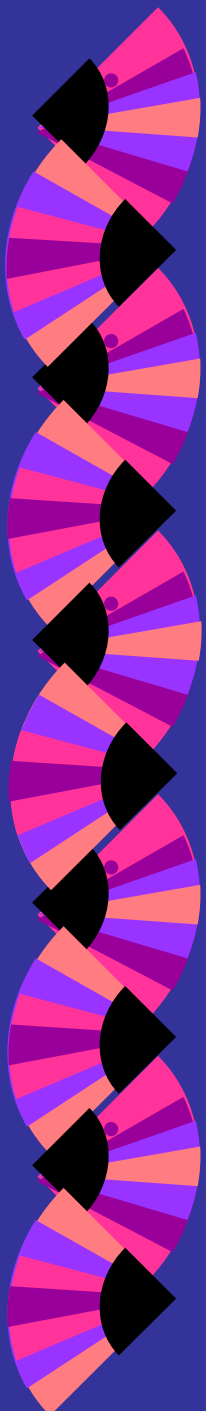|					
Mata*s London	Latte Merle	Sir Popeye Merle	Nojokebulldogs *Fetty Wap*	Vogue Merlot	Challenger The Dreamlandbull
					Hajosbulldy Elektra
				Shamrocks Brownie	Em And Em Of Shamrocks Pearl
					Curlys Of Shamrocks Little Gidjet
			Nojokebulldogs Little Symi	Shamrocks Rolo Buchanan	Em And Em Of Shamrocks Pearl
					Curlys Of Shamrocks Little Gidjet
				Nojokebulldogs**Symi	Curlys Topaz Treasure
					Creme Brulee Is Zardeliu
		Chikis	Fig Town **Pablo Esco**	Vogue Merlot	Challenger The Dreamlandbull
					Hajosbulldy Elektra
				Fig Town **Breezy**	Gway Rosco
					Fat Girl
			Moca	Magic	Titan
					Miss Bailey Bell
				Bella De La O	Throwdowns Canelo
					Daffy
	Pupee	Milo-La-Blue And Tan	Golden Bay Frenchies - Mr. Cujo - Black & Tan	Elegant Frenchie King Bobby Blk .Tan.	Spartacus
					Gracie Blue Jade
				Miss Chloe	Korosdombi Arnold
					Dolly Estrada
			Gabbana Estrella	Pacificbluefrenchbulldogz Ironman	Kromvel Iz Russkoi Skazki
					Calais Lady Of Grace
				Agate Is Zardeliu	Geits Gor
					Medea Nojaus Laivas
		Jazzy	Chevy Blue Palma	Big Boy Buky El Cherna	Chewy Ss
					Rosy
				Blue Sky	Hero
					Shadow E
			Desert City*s Hollywood Superstar	Butter Ball	Chewy Ss
					Blue Sky
				Desert City*s Eye Of The Tiger	Vanity Fur Ivy League Playboy Ace
					Mobulls Vanity Fur Lotsa Panache
Bombon	FBC Cochiloco	Morganzbullz King Cream	Aberz Cream Dream	Morganzbullz My Lilac Fawn	The Golden Prophet Eli
					Leona Rare Gery Bull*s At Morganzbullz
				Berryton Bonnie Boo	Diorbulls Kenny Rogers
					Here Comes Tallulah
			Morganzbullz Princespearl	The Golden Prophet Eli	Beast Nectar Of The Gods
					Harper At Baby Blue French Bulldogs
				Leona Rare Gery Bull*s At Morganzbullz	Marosmenti Csillag Dakota
					Gery Bulls Bambi
		Wcg French Bulldogs Sunshyne	Wcg French Bulldogs Too Short	Wcg French Bulldogs Flex	A.T.S.R's Charlie*s Secret Savage
					Wcg French Bulldogs Prestige
				Wcg French Bulldogs Trina	A.T.S.R'S King Aries
					A.T.S.R'S. Little Miss Caroline
			Wcg French Bulldogs Moonshine	Wcg French Bulldogs Dark Moon	A.T.S.R's Lenny*s Purple Haze
					A.T.S.R'S. Little Miss Maxcine
				Wcg French Bulldogs Pixy	Wcg French Bulldogs Chocolate Tie
					Wcg French Bulldogs Trifecta
	Fbc Runner	Nef69	Sir Bogey The Merle And Tan	610*s Fine Wine Merlot	Samuels Biscotti Of Dogtown
					610*s Galata **Red Bottoms**
				Bolitas	Batman Tri-Logy
					Blu Alabama Sugar And Spice
			Trifecta Of Motown	Kapone	Pacificbluefrenchbulldogz Picasso
					Bolitas
				Cookie	Frenchie-World **Gatsby** Blue&Tan
					Butterball Jean Harlow
		Star	Kc Exotic Bulldogs Gizmo Of Cal Line Bulls	Kc Exotic Bulldogs Jimmy The Pimp	Gustav Lamorena Del
					Ke Exotic Bulldogs Hazel
				Callinebulls Blue Storm	Pacificbluefrenchbulldogz Picasso
					Web Sitara
			Mula Bernabe	Black Jack Bleu	Buffalo Run Andre
					Shel-e*s Blue With Envy
				Simply Elegant Ariel Fleming	MojoAt ACA™S Most Obvious Journey Of Success

5 gen IC=0.0%   10 gen IC=1.2%   All gen IC=2.3%

Pedigree Analysis for Miranda's Lucky
I.C.= 0.0%/1.2%/2.3%

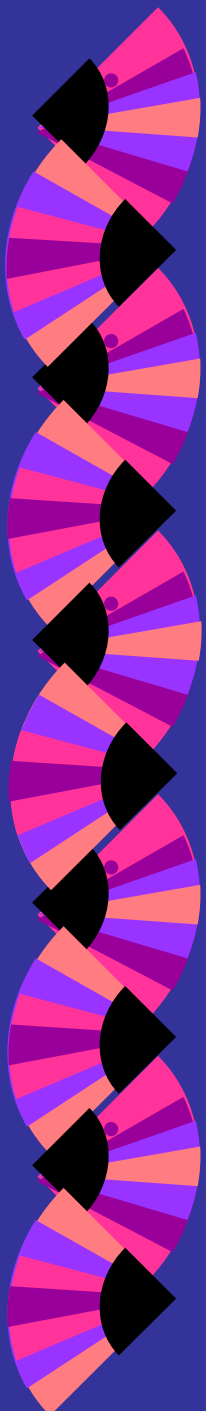| Linebred Ancestors	% Blood	1st Gen.	#Times
Belboulecan Du Champagne Mondo	7.0%	9	476
Terrette's Tourbillion D'Gamin	6.8%	16	909,926
Kolumb Iz Russkoi Skazki	6.7%	7	24
Kingsblood Kris	5.3%	7	21
Kromvel Iz Russkoi Skazki	4.9%	6	9
Nagyerdoi Champion Oszkar	4.8%	7	30
Truhali Skywalker At Glenlee	4.7%	9	305
Pacificbluefrenchbulldogz Ironman	4.9%	5	3
Belboulecan Histoire De Ma Vie	4.1%	11	963
Hampton's Chevalier	4.1%	16	195,210
Beast Nectar of The Gods	3.9%	6	4
Elegant Frenchie King Bobby	3.9%	5	2
Leos Gold Zhizel	3.6%	7	13
Affabulls King of Diamonds	3.5%	10	476

Inbreeding Coefficients vs. Depth of Pedigree

Gen	Fox Canyon's I Won The War At Goldshield	Empire N Bandog's Walk On The Water	Miranda's Lucky
2	0	0	0
3	0	3.1	0
4	1.2	5.1	0
5	1.3	7.4	0
6	1.8	10.7	0.3
7	2.1	11.1	0.6
8	2.7	12.1	0.7
10	4.1	14.8	1.2
12	5.4	16.7	1.7
All	5.7	17.4	2.3

Are absolute levels of breed homozygosity and differences in homozygosity between individual dogs important?

Yes 86%

No 14%
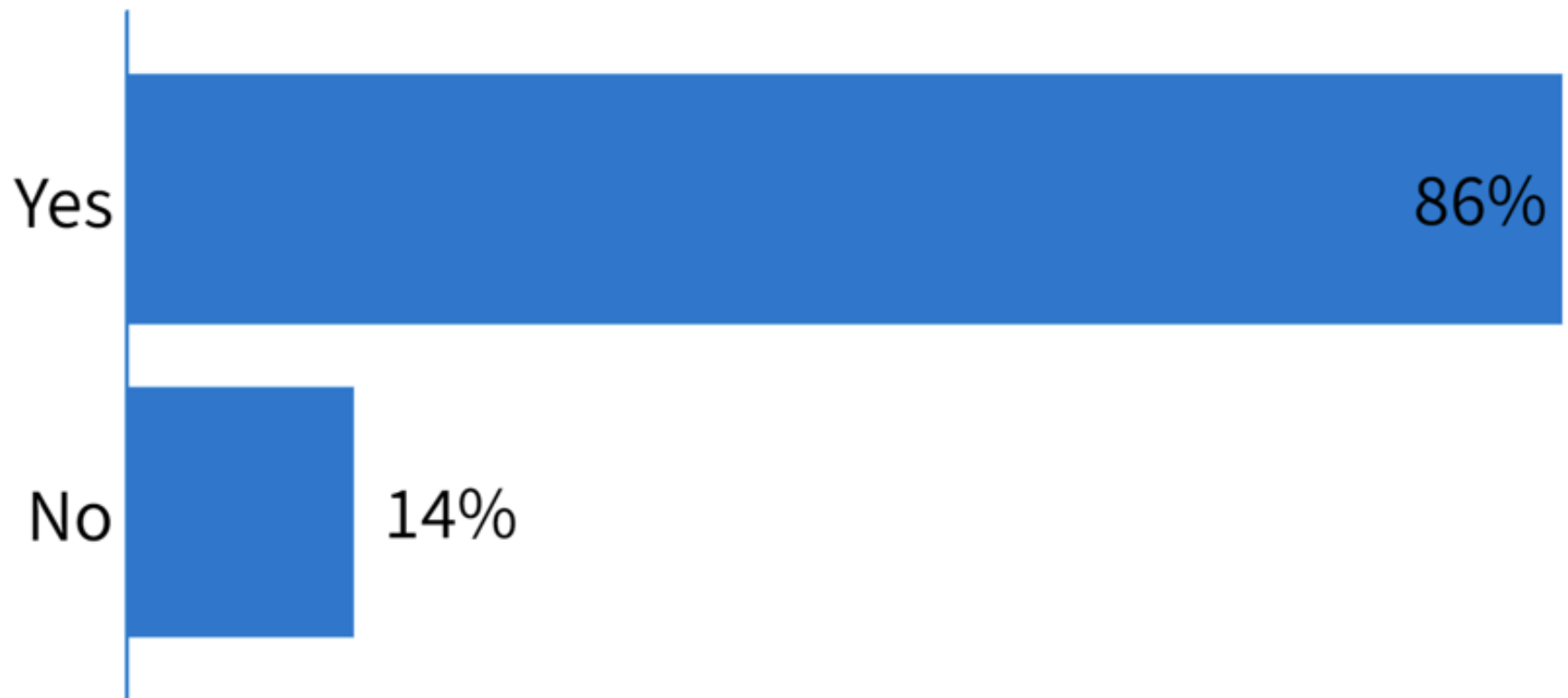
Why?

" Potential for detrimental recessives "

" In the wrong hands it could be detrimental in regards to the health of the offspring "

" In order to get consistent breeding, one needs to understand how a dog will produce itself "

Why?

" if the heritable traits are identified by homozygosity that would be informative "

" Disease "

" It gives us probability of disease "

" For predictability of genetic traits "

" Heterozygosity confers fitness/vigor "
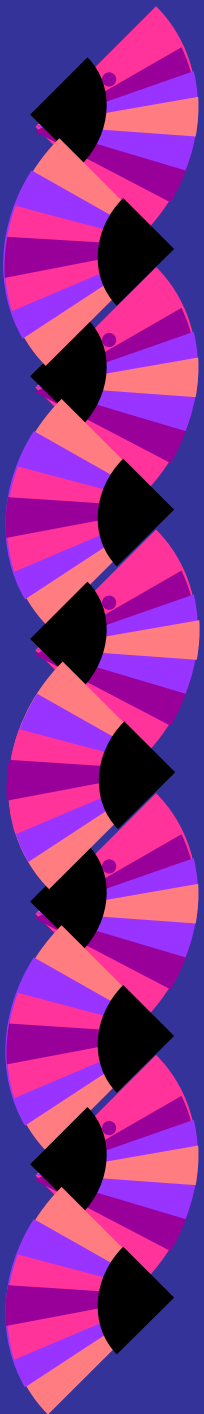
Why?

" To ensure undesirable traits aren't passed on "

" Fbdca "

" Might show consistency in what is produced "

" Unpreferable genes "

In order to understand about breeds, you must understand about breed evolution

The development of breeds occurred through artificial selection for body type, color, coat type, behavior, and conformational aspects

As breed lines became more specialized and stud books closed, those who did not conform to the standard were removed from breeding

Studies of dog breeds estimate that they lose on average 35% of their genetic diversity through breed formation

(Gray MM et. al. Genetics 2009; 181:1493-505)

Pedigree Analysis of Populations
A typical breed pedigree
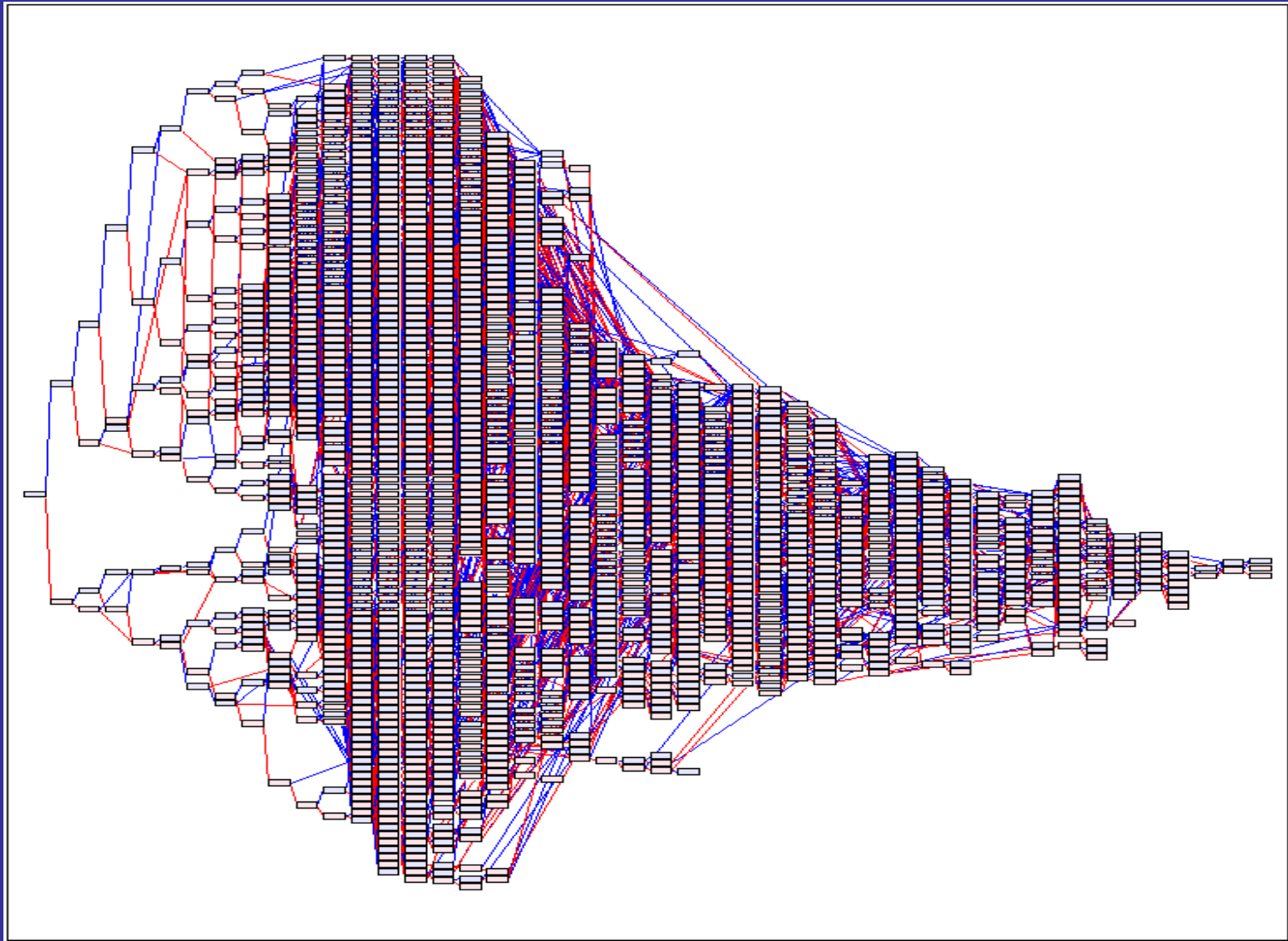
Any selection over generations will create

- **Homozygosity – uniform purposeful selection for breeding goals**
- **Diminished frequencies of undesirable genes**

Any selection will cause a loss of genetic diversity

This loss is not detrimental to the population, if it is directly related to increasing its superiority

Breed-defining genes would be expected to become homozygous due to selection over time

These include breed-selected traits for size, coat color & texture, behavior, skeletal morphology, and other traits

Even without close linebreeding, selection for positive traits will increase their homozygosity having originated from distant ancestors
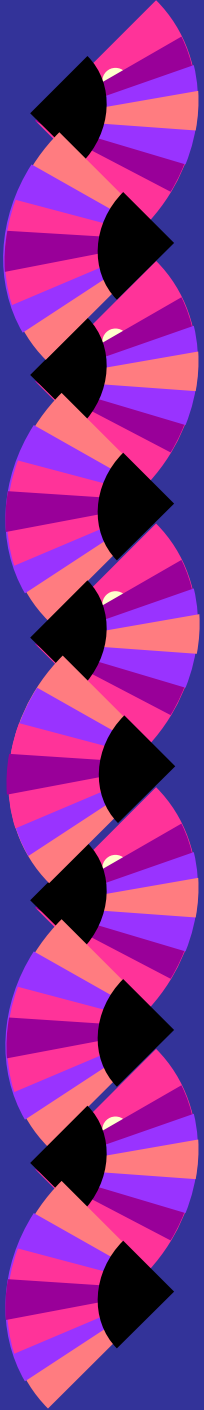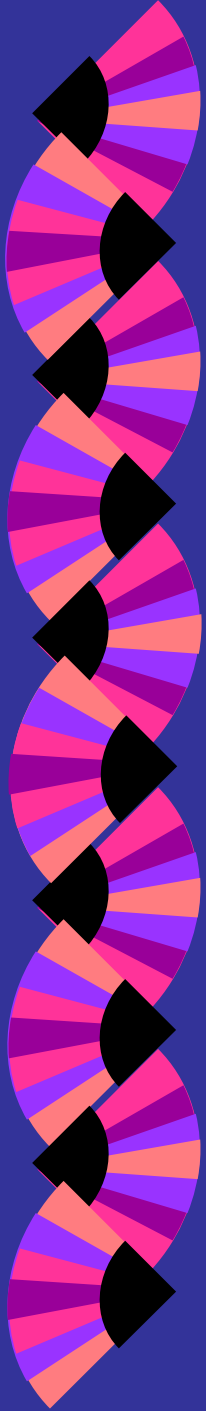
SELECTION

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Modern Breed Population Statistics

- High deep pedigree average inbreeding coefficients (homozygosity)

- Low effective population size (limited number of founders)

- High average relationship coefficients to influential ancestors

  - These ancestors appear in the pedigrees of every member of the breed, with genetic contributions of 15%, 35%

These are necessary and expected consequences of breed formation and evolution

Homozygosity is not inherently correlated to impaired genetic health, nor does it need to be artificially controlled

Healthy Breed Genes Pools Require Expanding, or Large Stable Populations

- Allows the creation of new "family lines"

- Allows for within-breed diversity

- Population contraction causes loss of breed diversity and quality breed lines
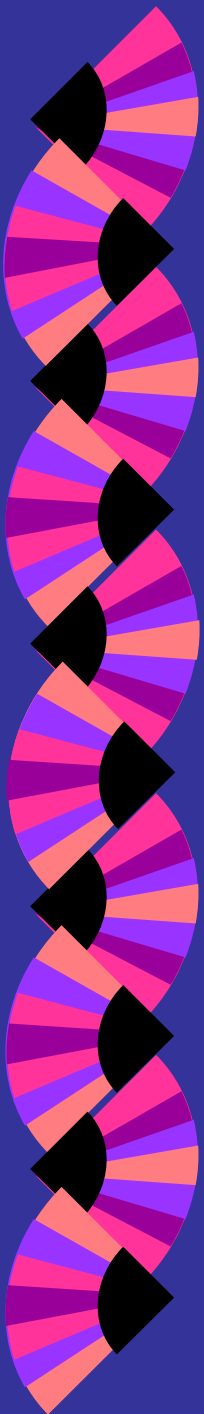
Selection of breeding animals should represent the quality traits and breadth of pedigree background

Quality lines should not be abandoned
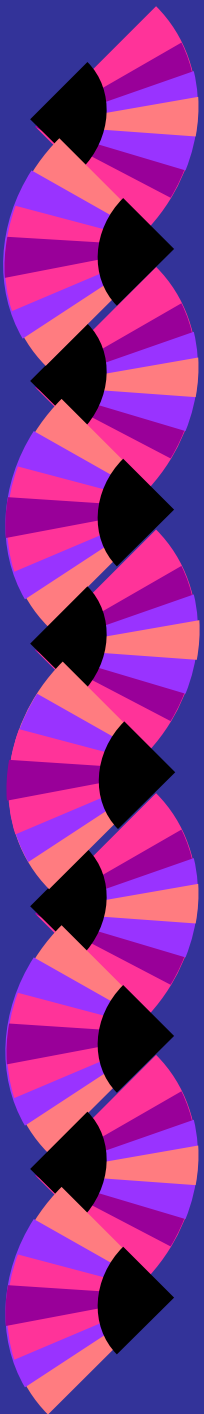
The Popular Sire Syndrome
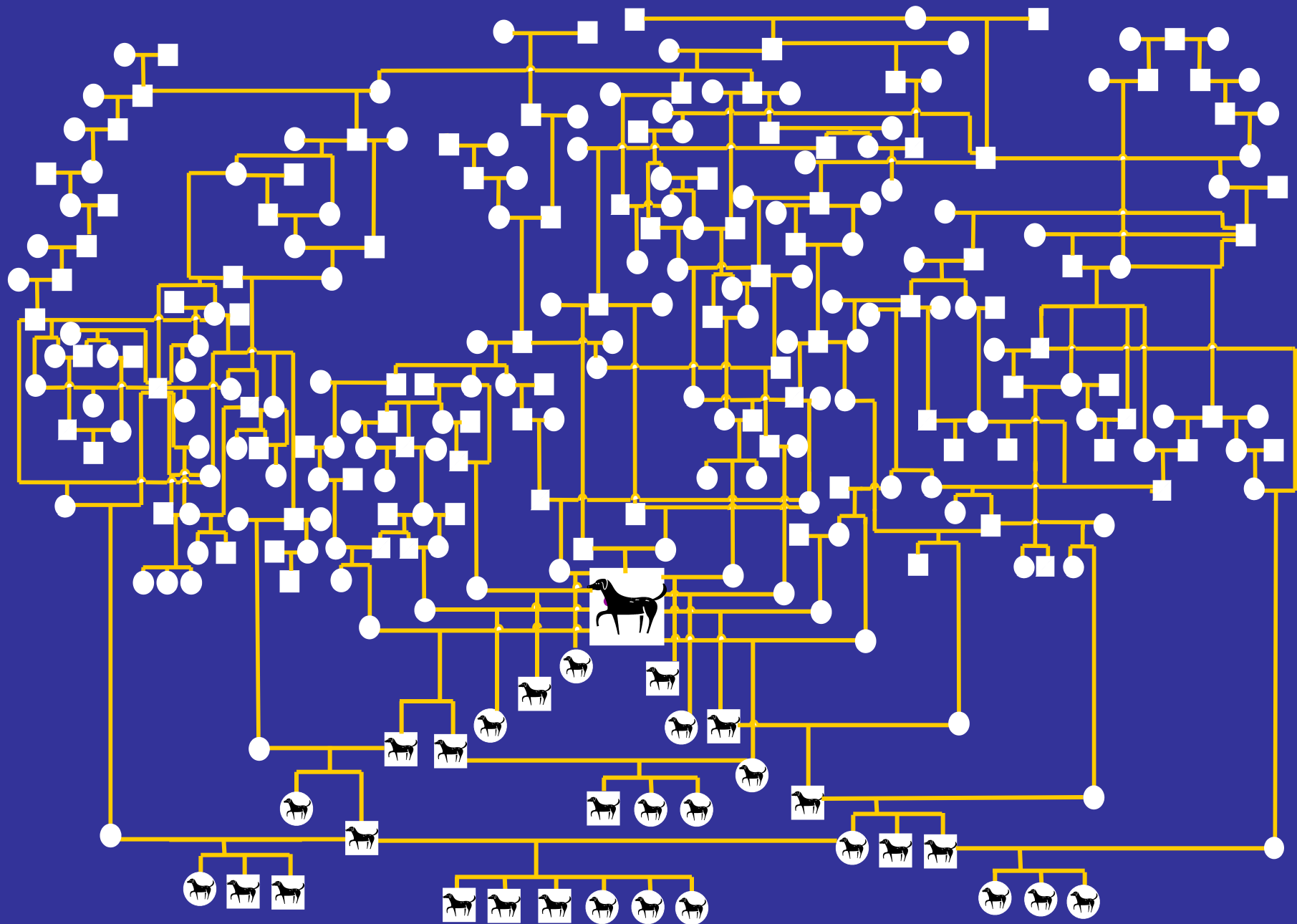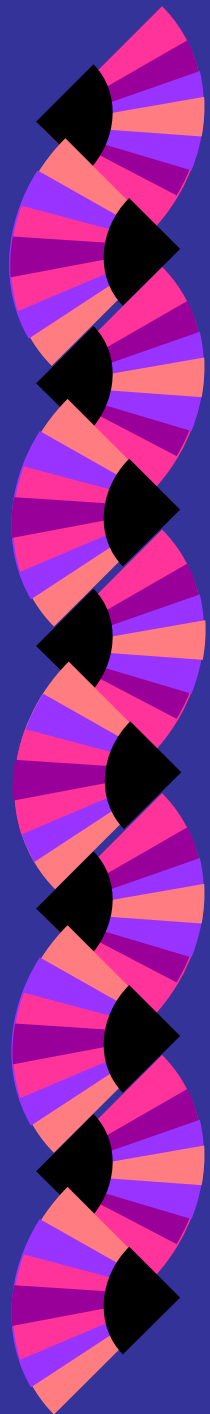
The popular sire syndrome is the single most influential factor in restricting breed gene pool diversity

- The overuse of a popular sire;
  - Quickly disseminates his genes throughout the gene pool without the benefit of evaluation over time
  - Causes the loss of other quality male lines that should be contributing to the gene pool

A popular sire's influence is different from that of an influential ancestor

- An influential ancestor's contribution is continually evaluated through it's descendants, who have to compete with others for breeding status

- If a popular sire is found to pass on deleterious genes, the resultant purging process also causes the loss of influence of the quality dam lines to which he was bred

Diseases and Disorders
The Dark Side of Breed Development

All individuals carry some deleterious mutations

- Quality individuals who propagate will also propagate their deleterious mutations

- These can cause breed-related disease if they are disseminated and increase in frequency through the founder's effect

Breed propagation must always include active monitoring and selection against genetic disease

Without this selection, the genetic health of the breed will decline

The genetic health of dog breeds is not a direct function of homozygosity or heterozygosity, but of the accumulation of specific disease liability genes

Breed Maintenance

In response to perceived concerns with genetic diversity, some advocate for homozygosity testing and SSP-type outbreeding programs

Recommendations to only outbreed (breed to those least related) homogenizes breeds and erases the genetic difference between individuals
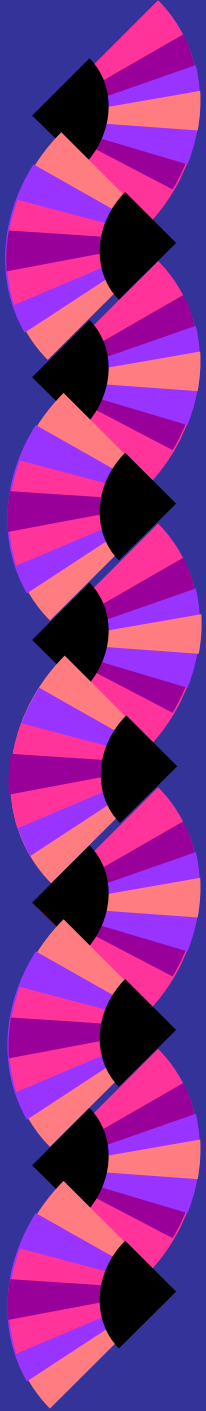
None of the types of mating systems (Inbreeding, Linebreeding, Outbreeding) change the frequency of defective genes, or their dissemination

Outbreeding will not change the frequency of deleterious genes

- For dispersed breed-related deleterious genes, outbreeding will not reduce the frequency of affected individuals
- Affected individuals will be produced in a random fashion

Genetic Diversity

♦ Molecular geneticists have discovered the tools to identify homozygosity within breeds

♦ In identifying these tools, molecular geneticists are instructing breeders to use these tools as goals of breeding and only outbreed to unrelated dogs and increase their "genetic diversity"

Genetic Diversity

- All breeds are inbred with many different parameters causing changes in their homozygosity and genetic diversity
- None of the manipulations recommended by molecular geneticist have to do with:
  - The health of the breeds
  - Selection for or against specific health or diseases or liability genes
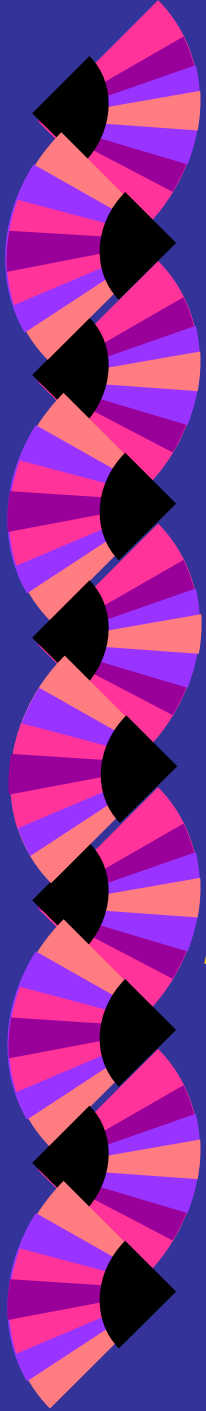
Selection for Heterozygosity

- Selects against **good homozygosity** accomplished through generations of selection

- Blindly increases minor frequency genes and chromosomal segments

- These are likely minor frequency due to selection over generations against undesirable and deleterious traits
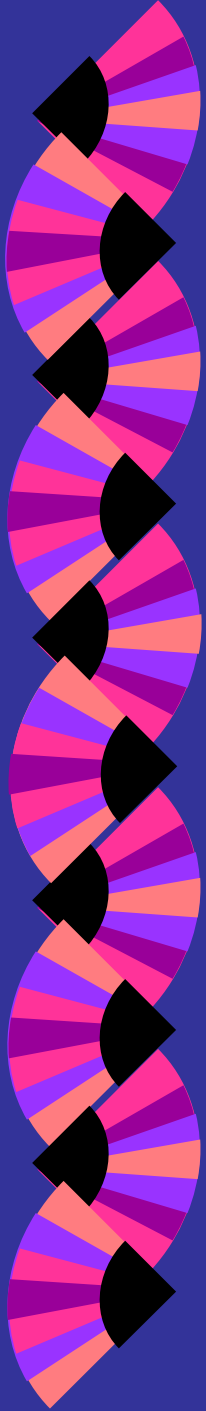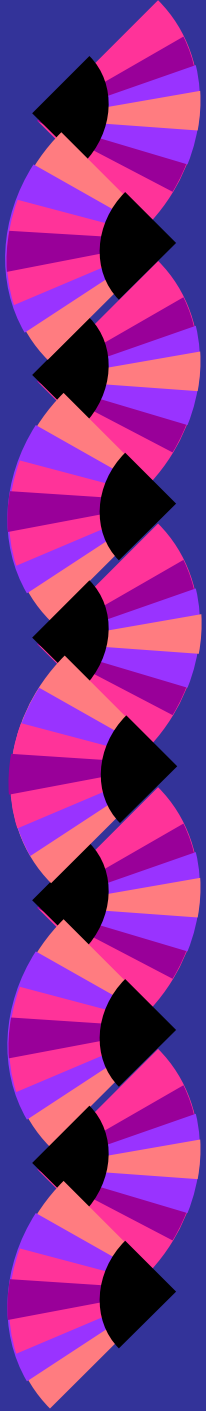
Genetic Diversity
=

It is the varied opinion of breeders as to what constitutes the ideal animal, and their selection of breeding stock that maintains breed diversity
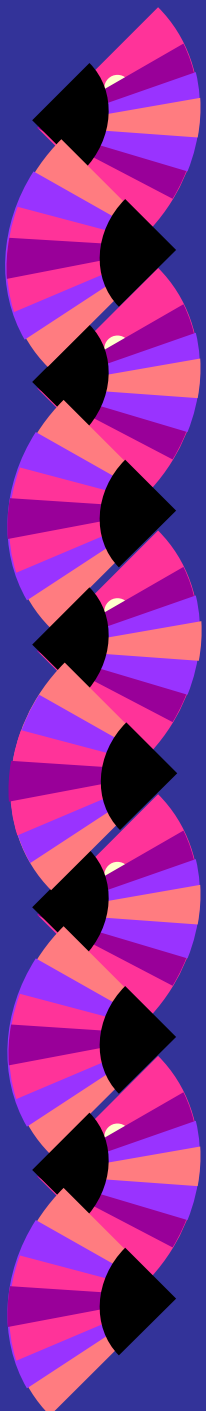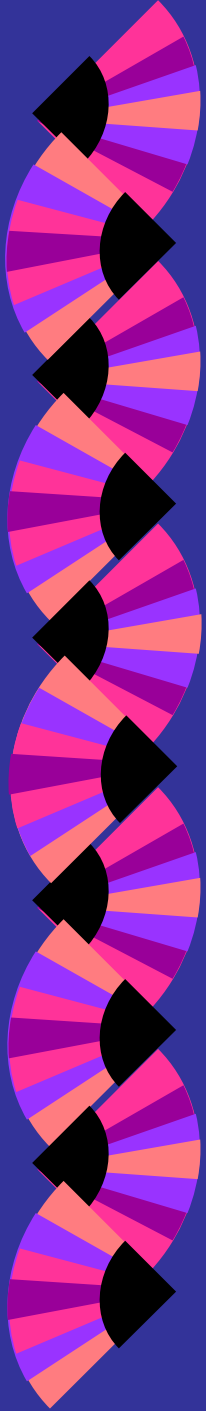
When breeds have issues with genetic disease, the only way to improve their gene pool is through **genetic screening** *and* **selection against** *the specific diseases* **and** *their associated* **liability genes**

Moderation away from extremes that cause disease should be a guiding principle in breeding and judging

Pre-breeding Health Screening

should become as

universal as

Equine Pre-purchase Exams

Breed Maintenance Requires;

1) Avoiding the popular sire syndrome.

2) Utilizing quality dogs from the breadth of your population to expand the gene pool.

3) Monitoring genetic health issues through regular health surveys.

4) Doing genetic screening for breed-related disorders.

5) Participating in open health registries to manage genetic disorders.

6) Constant selection for quality and health