




The Genomics of the American Mutt
How genes affect appearance and behavior in mixed-breed dogs

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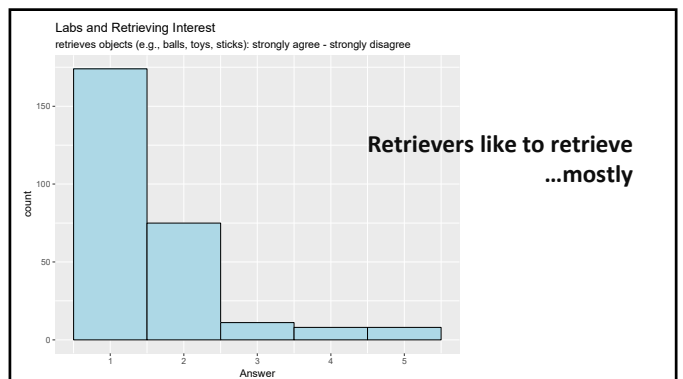
How can we safely place shelter dogs with unknown history and unknown genetics?

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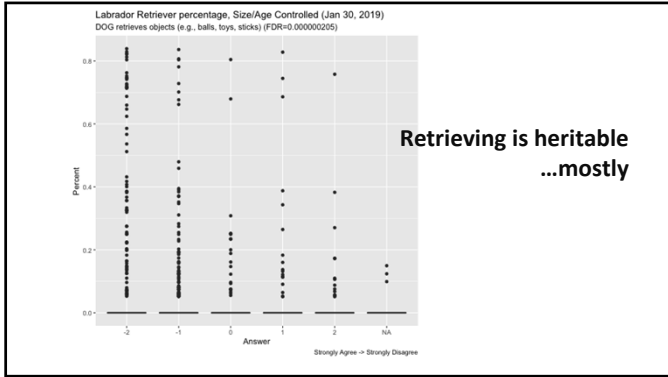


Herding
Herding
Guarding
Sight Speed
Retrieving
Guarding
Retrieving

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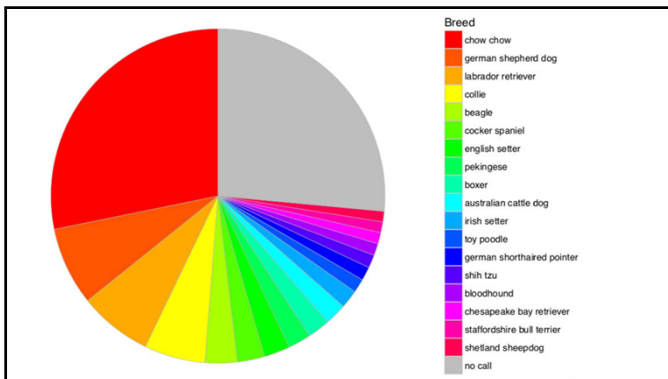
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"Ruby" Dog 1 of 31

Ruby's shoulders are **high high** when standing next to a person of average height.

Other physical traits or features:
White blaze on chest, white socks

- 31 mutts
- At least 3 breeds
- Guess top 3

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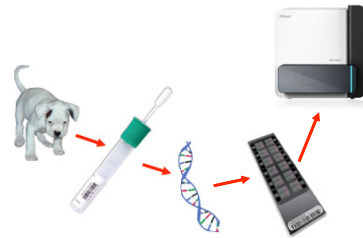
MuttMix.org: What we found



Some dogs had 19+ breeds!
Number of breeds doesn't correlate with correct answer
432,743 questions answered
25% accuracy overall
Professionals: 28% accuracy

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Could we genetically test for behavior?



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Single Nucleotide Polymorphisms (SNPs)

one letter difference

Dog #1 ATGCCGATCGTT
Dog #2 ATGCCAATCGTT



Most SNPs don't DO anything
Useful markers for tracing ancestry

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"Is this SNP correlated with my trait?"

correlated

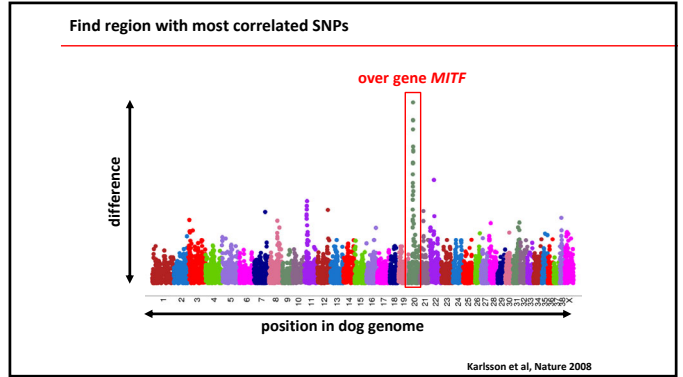
	CACCA	G	T	G	T	C	G	T	T	A	G
	CACCA	G	T	G	T	C	G	T	T	A	G
	CACCA	G	T	G	T	C	G	T	T	A	G
	CACCA	T	T	G	G	-	-	T	T	A	G
	CACCA	G	T	G	G	-	-	T	C	A	G
	CACCA	T	T	G	G	-	-	T	C	A	G

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Coat Color in Boxers

		
Solid	Flash	White
		
9 dogs	1 dog	10 dogs ~2% deaf


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hypothesis: regulation of M is disrupted



makes protein needed for pigment cell migration



Karlsson et al, Nature 2008

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White coat & Deafness <i>obeziana</i> bull terrier Karlsson et al, Nat Genetics	Ectodermal dysplasia <i>harlequin</i> breed Drögemüller et al, Science	Ridge & neural tube defect <i>Rottweiler</i> Ridgebacks Saitman-HK et al, Nat. Genetics
✓ single gene "Mendelian" traits		
		
Cone-rod dystrophy <i>discolorata</i> Wilk et al, Genome Research	ALS <i>Pike</i> breed Awano et al, PNAS	Osteoimperfecta <i>discolorata</i> Drögemüller et al, PLOS Genet

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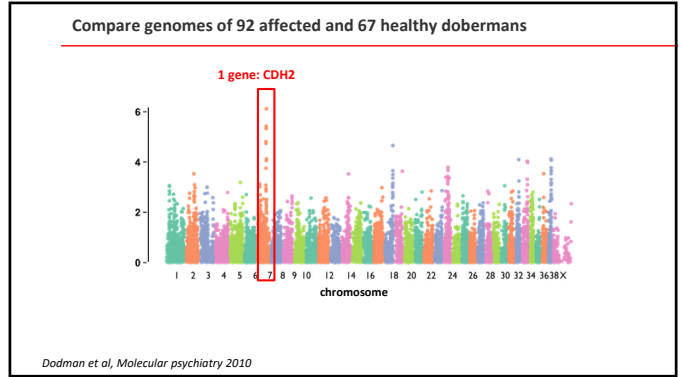
Compulsive disorder in dogs

normal behavior done too much
distressing, time-consuming and impairing
onset in adolescence
highly heritable
poor response to treatment (including SSRIs)

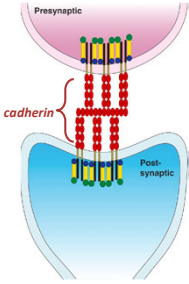
Movies by Alice Moon-Fanelli

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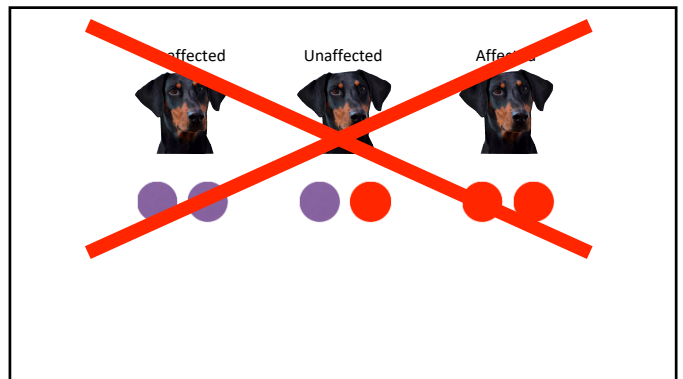
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Function of CDH2

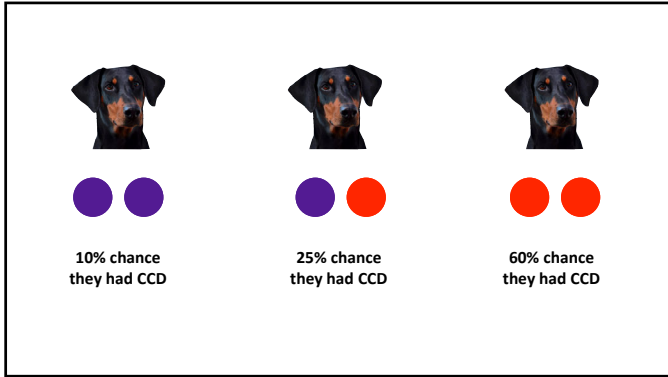


- Neural cadherin
- Found in glutamatergic synapses
- Synaptic plasticity (learning and memory)

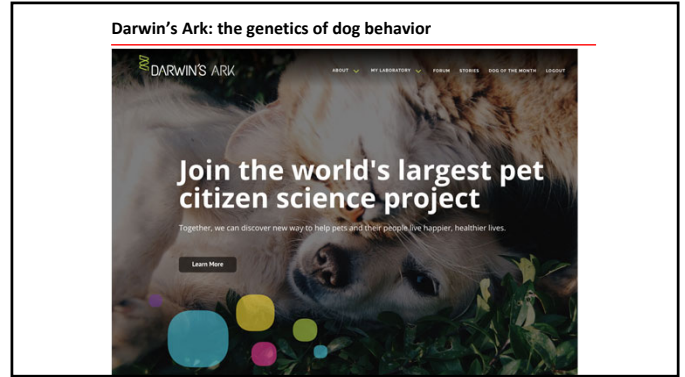
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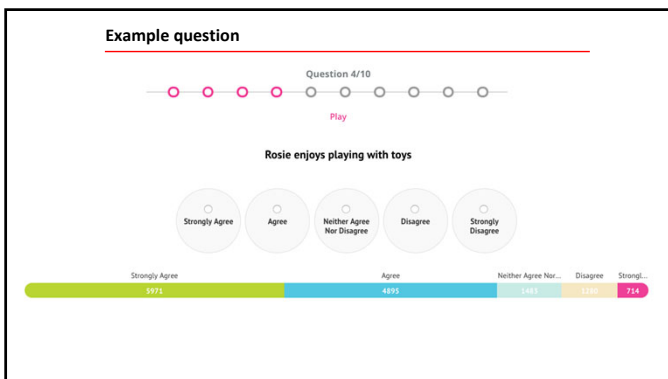
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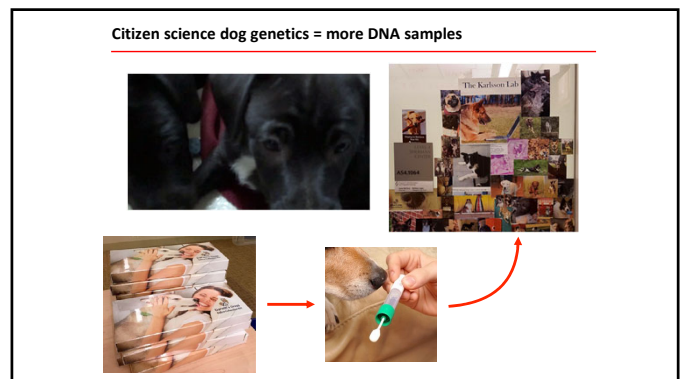
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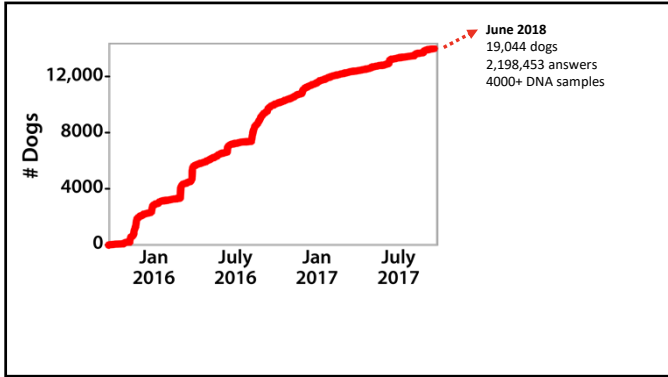
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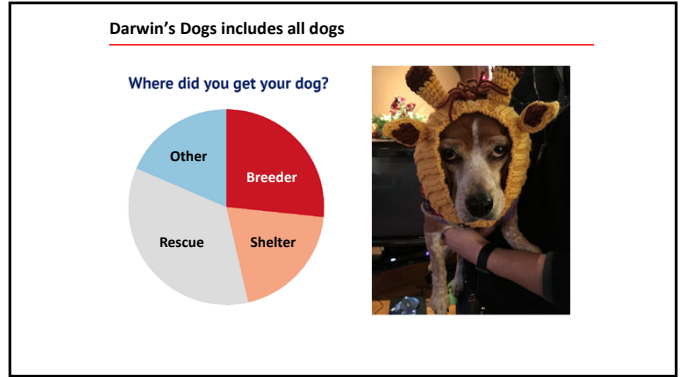
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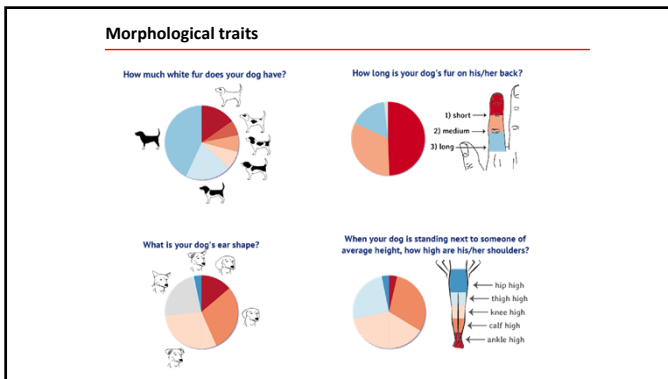
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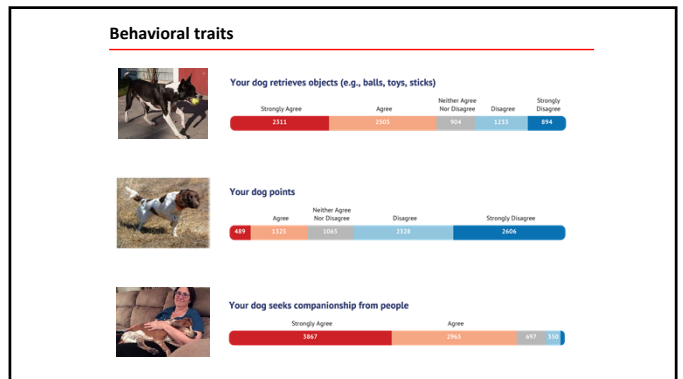
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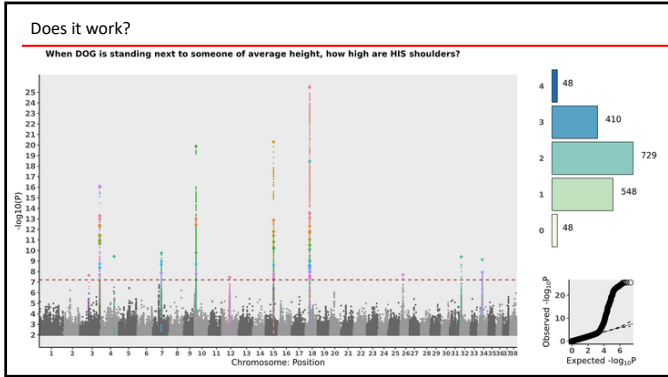
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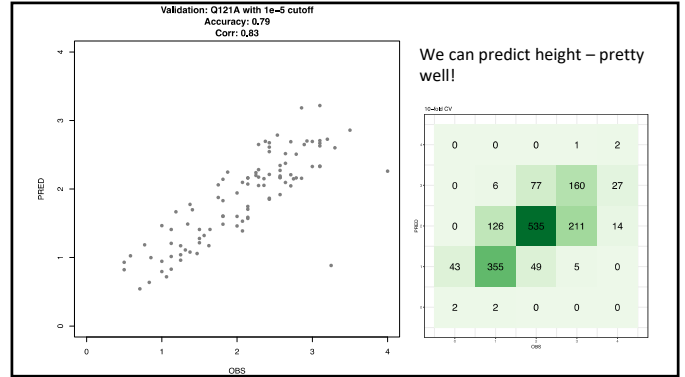
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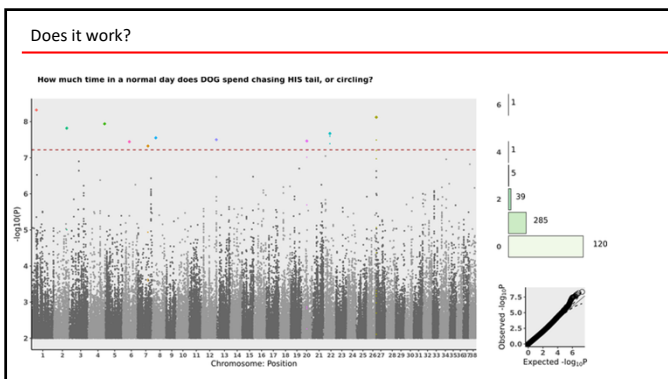
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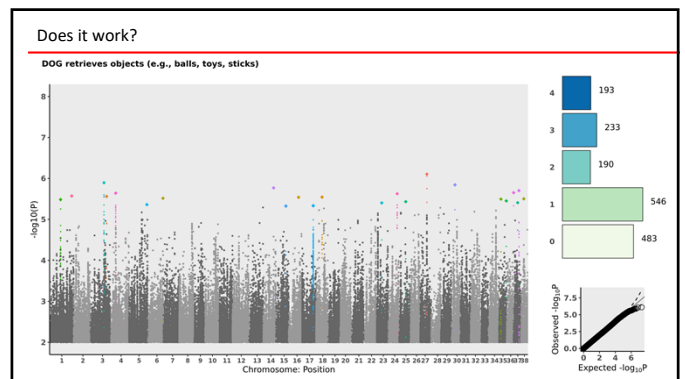
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A painting of a dog, possibly a Weimaraner, in a small wooden boat with a single mast and a large, light-colored sail. The dog is looking out over a dark, choppy sea under a grey, overcast sky. The style is somewhat impressionistic with visible brushstrokes.

Acknowledgements

@UMass
Kathryn Lord
Brittney Logan
Shirley Xue Li
Gaurav Chauhan
Kathleen Morrill

IAABC
Marjie Alonso
Adria Karlsson
Many, many others

@Broad
Elinor Karlsson
Michele Koltroukian
Jeremy Johnson
Ross Swofford
Diane Genereux
Jacob Alonso

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Thank you to the organizations, owners, and dogs!
darwinsark.org