Scientific Question

Can genetic differences, specifically with the GTF2I and GTF2IRD1 genes, between dogs and cats help determine which animal has better characteristics (more friendly) to be a pet?

Scientific Hypothesis

If the GTF2I and GTF2IRD1 genes makes dogs more friendly, then either the presence of GTF21 and GTF2IRD1 or expression of GTF21 and GTF2IRD1 will dictate whether cats can have the same friendly personalities as dogs.

Background

articles: Bennett, Assessment of domestic cat personality, as perceived by 416 owners, suggests six dimensions (Links to an external site.), 2017, Elsevier

MacLeant, Highly Heritable and Functionally Relevant Breed Differences in Dog Behavior (Links to an external site.), 2019, BioRxiv

The article discovered that genotype accounts for more than 50% of variation in behaviors, Individual SNPs associated with behaviors fall in genes that are disproportionately expressed in the brain, and variants associated with breed differences in behavior within foxes are also seen within human behavioral genetics (which suggest similar patterns across species) Utilized questionnaire to get behavioral data, then used clustering, GWAS, and gene oncology for data analysis Further emphasizes that behavioral traits within dogs are largely due to genetics. Figure 2 most relevant This article presents a new idea that within the dog family, behavior can vary depending on dog breed How does variation across dog breeds affect dog behavior?
O'Brien, State of cat genomics (Links to an external site.), 2008, NCBI

1.
2. utilized a lot of clustering
3. can use the DNA sequence from this article to compare
4. This article was the first to sequence the whole genome of an Abyssinian cat
5. What can having the full genome of a cat tell us?

Salonen, Breed differences of heritable behaviour traits in cats (Links to an external site.), 2019, Scientific Reports

The article detected significant difference in social and non-social behavior depending on cat breed, concluded that traits were heritable and many of them were phenotypically and genetically correlated, and determined which traits amongst breeds were most likely to be inherited Used questionnaires sent to cat owners and then logistic regression analysis was utilized on the responses This article sets up the framework that cats have personality traits that seem to be genetically influenced. Figure 4 or 3 most relevant This article was the first to examine heritability of behavior in cats Do different breeds of cats have different behavioral patterns? Vonholt, Structural variants in genes associated with human Williams-Beuren syndrome underlie stereotypical hypersociability in domestic dogs (Links to an external site.) , 2017, Science Advances

the article identified a locus associated with WBS humans which is also known to be positively selected in dog genomes, found significant association between GTF2I and GTF2IRD1 genes and WBS behaviors, and found significant association between TE copy number and behavior (why domestic dogs are friendlier than wolves) behavior tests followed by DNA blood samples and then de novo annotation on structural variants
This article sets up the framework that there is a gene that makes dogs a friendly pet. Figure 1 and 2 were most relevant. this article presents a new idea because it connects the human's Williams Syndrome with dogs Do the same genes that cause Williams-Beuren syndrome in humans make dogs more sociable?

Bioinformatics methods

I would use BLAST search to see if cats also have the GTF2I and GTF2IRD1 genes as dogs. I would also use homology modeling to see if other regions of a cat's and a dog's sequence match. Then to visualize the data, I would use a bar graph to show gene overlap.

Code

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