

Spring 3-2014

Genetic Canine Agression

Isabella O'Toole

Follow this and additional works at: https://digitalcommons.usm.maine.edu/thinking_matters



Part of the [Animal Sciences Commons](#), [Genetics and Genomics Commons](#), and the [Other Social and Behavioral Sciences Commons](#)

Recommended Citation

O'Toole, Isabella, "Genetic Canine Agression" (2014). *Thinking Matters Symposium Archive*. 6.
https://digitalcommons.usm.maine.edu/thinking_matters/6

This Poster Session is brought to you for free and open access by the Student Scholarship at USM Digital Commons. It has been accepted for inclusion in Thinking Matters Symposium Archive by an authorized administrator of USM Digital Commons. For more information, please contact jessica.c.hovey@maine.edu.

Genetic Canine Aggression

Isabella O'Toole SMCC Advisor: Elizabeth Ehrenfeld

Abstract:

Canine aggression can pose a serious concern for public and animal welfare. Most of what we know about aggression comes from bite statistics, expert opinions and breed-specific aggressiveness. These sources can often be misleading due to biases toward large or powerful breeds. In this review, I will examine a study that suggest a small number of genes control aggression. In these studies a variety of dogs were used. Canine Behavioral Assessment and Research Questionnaire (C-BARQ) and observation were used to determine the aggressive level of each dog. The dogs used in the study were euthanized and their cerebral spinal fluid (CSF) was examined.

Serotonin and Homovanillic Acid Background Information:

5-HIAA is the main metabolite of serotonin. The serotonin transporter (aka SERT or 5-HTT) is a type of monoamine transporter protein that transports serotonin from the synaptic cleft to the presynaptic neuron. Studies in mice show that the length variation in 5-HTTLPR (serotonin-transporter-gene-linked polymorphic region) have been found to partly account for anxiety related personality disorders and it also alters the expression of 5-HTT. Serotonin has been shown to decrease impulsive behavior.

HVA is associated with dopamine levels in the brain. The dopamine transporter (DAT) gene is known to have a variable number of tandem repeat of polymorphism in the 3' non-coding region. Differences in the repeats have been shown to affect the expression of the transporter and lead to psychiatric disorders.

Methods:

- 21 dogs were included in the aggressive group and 19 were included in the control group.
- The dogs were humanly euthanized
- CSF aliquot no. 2 was used for metabolite analysis
- Concentrations of 5-HIAA, homovanillic acid (HVA), dopamine, MHPG, norepinephrine were measured with liquid chromatography using electrochemical detection

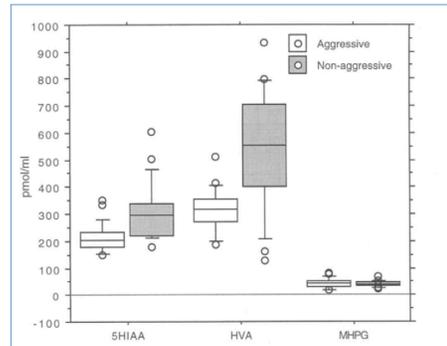


Figure 1. Box plot of CSF 5-HIAA, HVA, and MHPG concentrations in 21 dominant-aggressive and 19 non-aggressive dogs ((Reisner, Mann, Stanley, Huang, and Houpt)



Figure 2. Sharky The Pit bull (www.facebook.com/PitBullSharky)

Behavioral category	Variable	Number of dogs		5-HIAA		HVA		MHPG	
		agg	non	agg	non	agg	non	agg	non
Impulsivity/dishabience	Bites without warning ¹	16	3	196.8	244.0	302.0	400.0	41.0	38.8
	Lacerates or punctures skin ¹	17	4	197.4	239.0	302.0	367.4	38.6	46.0
Aggression	Bites > once per episode	5	14	207.0	212.4	330.0	321.4	39.4	45.0
	Circumstances are unpredictable	15	4	197.4	238.0	328.0	351.0	41.6	48.4
Circumstances ⁴	Trembles during episodes	10	5	217.4	226.0	330.4	356.0	40.4	48.2
	Attends to people	9	10	207.0	212.4	326.0	321.4	39.4	45.0
Circumstances ⁴	Owner present or voice – no contact	10	5	214.6	202.0	330.4	356.0	48.4	41.6
	Positive contact by owner	13	5	223.6	202.0	335.0	318.0	46.4	38.6
	Threatening contact by owner	7	9	234.0	207.0	326.0	335.0	46.4	48.2
	Passive/neutral	13	3	202.0	226.0	326.0	356.0	41.6	48.2
	Disrupted while resting	14	3	216.4	202.0	330.4	255.0	46.4	32.6

Figure 3. Characteristics of aggression and median CSF 5-HIA, HVA, and MHPG values of 21 dominant-aggressive dogs (Reisner, Mann, Stanley, Huang, and Houpt)



Figure 4. A high performance liquid chromatography, equipped with a diode array detector, a fluorescence detector, and an electrochemical detector (www.aub.edu.lb)

Results:

- 5-HIAA and HVA levels were lower in dominant-aggressive dogs than the control group (Figure 1)
- Median concentrations for 5-HIAA in aggressive group was 202.0 pmol/ml. The median concentration in the control group was 298.0 pmol/ml.
- Median concentration of HVA in aggressive group was 318.0 pmol/ml. Median concentration for control group was 553.0 pmol/ml
- This finding is consistent with studies in humans, non-human primates and rodents in which low level of 5-HIAA have been found to be associated with aggressive behavior.

References

- Murphy DL, Lesch KP (February 2008). "Targeting the murine serotonin transporter: insights into human neurobiology". *Nature Reviews Neuroscience*.
- Lesch KP, Bengel D, Heils A, Sabol SZ, Greenberg BD, Petri S, Benjamin J, Muller CR, Hamer DH, Murphy DL (November 1996). "Association of Anxiety-Related Traits with a Polymorphism in the Serotonin Transporter Gene Regulatory Region".
- Murphy DL, Lesch KP (February 2008). "Targeting the murine serotonin transporter: insights into human neurobiology". *Nature Reviews Neuroscience*.
- Miller GM, Madras BK (2002). "Polymorphisms in the 3'-untranslated region of human and monkey dopamine transporter genes affect reporter gene expression". *Mol. Psychiatry*
- Reisner, Ilana R., J. John Mann, Michael Stanley, Yung-Yu Huang, and Katherine A. Houpt. "Comparison of Cerebrospinal Fluid Monoamine Metabolite Levels in Dominant-aggressive and Non-aggressive Dogs." *Brain Research* 714.1-2 (1996): 57-64. Print.