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# Genetic Canine Aggression

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## 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

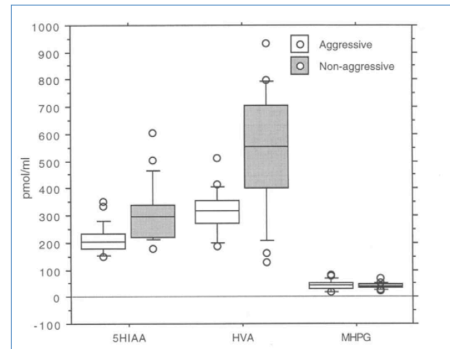


Figure 1. Box plot of CSF 5-HIAA, HVA, and MHPG concentrations in 21 dominant-aggressive and 19 non-aggressive dogs ((Reisner, Mann, Stanley, Huang, and Houpt)



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 <sup>1</sup>	16	3	196.8	244.0	302.0	400.0	41.0	38.6
	Lacerates or punctures skin <sup>1</sup>	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	320.0	351.0	41.6	48.4
Circumstances <sup>4</sup>	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 <sup>4</sup>	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/unknown	13	3	202.0	226.0	326.0	356.0	41.6	48.2
	Disinfect 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.

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