

Year VI, v.1 2026 | Submission: 08/02/2026 | Accepted: 10/02/2026 | Publication: 12/02/2026

The Importance of Hippocampal Stimulation in the Detection of Narcotic Substances by Police Sniffer Dogs in Operations in Complex Areas: An Analysis of Canine Olfactory Memory for Police Use

The Importance Of Hippocampal Stimulation In The Detection Of Narcotic Substances By Military Police Detection Dogs In Operations In Complex Areas: An Analysis Of Canine Olfactory Memory For Police Use

Jônatas Torres da Silva - Amazonas State University

Summary

The central objective of this research is to highlight the importance of hippocampal stimulation in the detection of narcotic substances by police sniffer dogs in operations in complex areas, through an analysis of canine olfactory memory for police use. To this end, qualitative research was used as a methodological instrument, through bibliographic research in articles, books, and journals related to the thematic area addressed. This aimed to identify the importance of canine olfactory memory in narcotics search operations. The bibliographic results reveal that the study of the canine hippocampus has proven to be a valuable tool in training and, consequently, in police operations for narcotics searches, since the hippocampus presents itself as an important marker in canine olfactory memory when detecting volatile compounds from narcotics.

Keywords: Hippocampus; Olfactory memory; Detection; Sniffer dogs; Narcotics.

Abstract

The main objective of this research is to assess the importance of hippocampal stimulation in the detection of narcotic substances by police sniffer dogs during operations in complex areas, through an analysis of canine olfactory memory for police use. To achieve this, qualitative research was employed as a methodological tool, through a bibliographic review of articles, books, and journals related to the thematic area under study. The aim is to identify the significance of dogs' olfactory memory in narcotics search operations. Bibliographic results reveal that the study of the canine hippocampus has proven to be a valuable tool in training and, consequently, in police operations for narcotics searches, as the hippocampus serves as an important marker in canine olfactory memory when detecting volatile compounds from narcotics.

Keywords: Hippocampus; Olfactory memory; Detection; sniffer dogs; Narcotics.

1. INTRODUCTION

According to Beck and Katcher (2003), the dog was domesticated in the history of humankind by Humans have been interacting with humans for thousands of years, with the first interaction focused on obtaining food, which Later, it joined humans in hunting, even helping in locating and capturing prey. prey, making the human-dog bond ever stronger.

According to Beck and Katcher (2003), over the years, once domesticated, they were trained. to perform numerous activities, both for military and civilian purposes, such as: guiding people with special needs; facility security; protection; search and rescue; expertise; Locating explosives, sniffing out narcotics, as well as the domestic dog that ends up in many homes. by becoming a member of the family, among other activities. In this sense, the use of dogs by the being In addition to being an excellent work tool, the human also serves as a loyal companion. partner.

Year VI, v.1 2026 | Submission: 08/02/2026 | Accepted: 10/02/2026 | Publication: 12/02/2026

In police work with dogs in highly complex environments, specifically, dogs

They are used in the search for missing persons, the capture of individuals, and in riot control operations. prisons, sports arenas, firearm detection, corpse searches, and especially in scent detection. of narcotics.

Considering that the constitutional role of the Military Police is to provide a sense of security.

From this perspective, the scientific question that arises is: which public policing, through visible policing, The importance of hippocampal stimulation in the detection of narcotic substances by dogs.

Are police sniffer dogs used in operations in complex areas?

To resolve this issue, a guiding hypothesis was proposed that the stimulus of The hippocampus, combined with olfactory stimuli, ensures better olfactory memory performance. dog, providing better results in detecting narcotic substances that go beyond the Training for complex operational areas.

In this context, the overall objective is to highlight aspects of canine olfactory memory combined with... Training and stimulation of the animal's hippocampus. The following specific objectives were used for this purpose:

1. Analyze important aspects of the canine hippocampus through training.
1. Focused on the detection of narcotic substances; 2. To recognize some narcotic odors.

Conditions for canine detection training; 3. Observe what large-scale operations are.

complexity surrounding detection dogs.

From this perspective, the importance of this scientific research for society is recognized, since that the role of the military police officer for the community is quite broad, ranging from a conception centered on "preservation of public order," which is a fragment of Article 144 of the 1988 Federal Constitution.

which clarifies that public safety is the duty of the State, a right and responsibility of all, and is exercised for the preservation of public order and the safety of persons and property.

(BRAZIL, 1988) and combating crime, up to the understanding of a police officer providing service.

A public official, a forensic police officer knowledgeable in the science involved, operating with detection dogs It's science.

This work also implies actions in the academic sphere, in the areas of research and extension, combined with a social commitment to the scientific and humanitarian advancement of the military police. In other words, intellectual production within the academic sphere is of utmost importance, because...

Scientific productions in their various manifestations and materializations are configured as Mechanisms for disseminating research results that move beyond the academic realm and take on a more formal form. within the police institution and in society, it is through intellectual production that the institutional demarcations and externalized activities that initially take place in contexts within the walls, in order to seek integrated social development. The realization of this study also This will provide professional development for the author who, in addition to being a military police officer, also works

Year VI, v.1 2026 | Submission: 08/02/2026 | Accepted: 10/02/2026 | Publication: 12/02/2026
in the Canine Policing Unit.

This article is subdivided into a theoretical framework, which addresses the main authors, which deal with the analysis of canine behavior, canine olfactory memory, and analysis of canine hippocampus; methodological section, which details the methodological procedures used during the research; results and discussion, where the research results are presented; and the conclusion, with the final considerations of the author of the research, based on the results obtained.

2. THEORETICAL FRAMEWORK

In this section, we sought authors who address the topic, thus providing a better understanding. We will address topical issues such as canine hippocampal analysis, canine olfactory memory, narcotics, police sniffer dogs, and operations in complex areas.

2.1 Canine Police Operations in Complex Areas

Police operations in complex areas are tactical interventions carried out by forces of security in urban areas characterized by high rates of organized crime, High population density, poor infrastructure, and often, control by groups. criminals.

These actions aim to combat violent crimes, execute warrants, and regain control of... Public order demands a high level of technical, tactical, and psychological expertise due to the extreme risk of conflict. armed.

Legally, in Brazil, the police are state bodies with a constitutional purpose. to preserve public order, to protect people and property, and to carry out investigations and repression. of crimes, in addition to controlling violence. The Federal Constitution of 1988 (BRAZIL, 1988), in its Article 144 establishes that public security is the duty of the State, and the right and responsibility of all. It is exercised through the following bodies: 1) Federal Police; 2) Federal Highway Police; 3) Police Federal Railway; 4) Civil Police; 5) Military Police and Military Fire Departments (BRAZIL, 1988).

Police operations in complex environments refer to coordinated actions carried out by Public security forces with the objective of preventing, investigating, and suppressing criminal activities. These operations can vary in scale, from routine actions in high-crime areas to... Large-scale operations involving multiple agencies and significant resources.

There are various types of police operations, each with its own characteristics and objectives. Specific operations can be classified as drug trafficking suppression operations, Combating organized crime, patrolling vulnerable areas, among others. Each type The operation requires differentiated strategies and the mobilization of adequate resources to achieve the

Year VI, v.1 2026 | Submission: 08/02/2026 | Accepted: 10/02/2026 | Publication: 12/02/2026

Expected results, especially when it comes to operations involving dogs.

The results of police operations are often evaluated in terms of arrests.

Operations carried out included the seizure of drugs, weapons, and other items related to crime. Furthermore, the impact in the community and the population's perception of safety are also important indicators of Successful operations in highly complex environments.

2.2 Narcotics Sniffing Dogs

According to Do Valle (2022), drug-sniffing dogs, often called K9s, They are essential agents in the fight against drug trafficking, operating in airports, highways, ports and Police operations in high-risk areas. They utilize a sense of smell hundreds of times more powerful than the humans to identify illicit substances such as marijuana, cocaine, ecstasy, MDMA, heroin, among others. several others.

Lopes (2019) states that training is based on play-based techniques, through The dog associates the smell of the drug with its favorite reward, usually a toy. like a teething ring or ball.

Contrary to popular myth, dogs are not addicted to drugs. They train with samples. real or simulated odors are placed in safe containers, and children learn to identify specific odors without... to come into direct contact with the illicit substance.

They are considered one of the most accurate weapons in the fight against crime, being capable of finding drugs hidden in places where humans would take hours or not They would be able to locate it.

2.3 Narcotic Substances

Narcotic substances, often called psychoactive or psychotropic drugs, They are chemical compounds that alter the functioning of the central nervous system (CNS). They alter the state of consciousness, mood, behavior, and cognition, and can cause dependence. physical or psychic, and vary between natural, semi-synthetic and synthetic (BRAZIL, 2006).

They act by altering brain activity, and may have depressant effects by slowing down the system. central nervous system, stimulants (which speed up) or disruptors/hallucinogens, which alter perception.

Drug trafficking in Brazil is defined by Article 33 of Law No. 11.343/2006, which punishes it with... Imprisonment for 5 to 15 years and a fine applies to conduct such as importing, selling, transporting, or possessing illicit substances without authorization. It is a crime considered heinous, not subject to bail, and not eligible for pardon or clemency. amnesty.

Year VI, v.1 2026 | Submission: 08/02/2026 | Accepted: 10/02/2026 | Publication: 12/02/2026

2.4 Canine olfactory memory

According to Bazilio (2023), canine olfactory memory is the ability of dogs to store, recognize, and associate smells with experiences, places, people, or emotions, using their sense of smell is about 40-50 times more powerful than that of humans. With up to 300 million receptors, they store "olfactory signatures" for years, which is essential for location and emotional connection.

Dogs use their sense of smell to recognize the various odors of narcotics, remembering-if they last for years. The hippocampus is connected to the olfactory bulb, which is connected to the amygdala (center). (emotional), allowing specific scents to evoke the joy of receiving the reward, through based on the indication of the specific odor.

Lopes (2019) states that canids have a brain area for smells that is 40% larger than Humans can identify odors at concentrations 100 million times lower. Essential. to create mental maps in order to find hidden narcotics. This skill transforms The sense of smell is the primary means by which dogs perceive the world, being more important than sight for them. Cognition and memory.

2.5 Canine Hippocampus

According to Gould and Reeves (1999), the hippocampus is a fundamental brain structure located in the [temporal lobe](#), belonging to the limbic system. It plays a crucial role in the formation of new memories (short and long term), in the consolidation of episodic memories and in navigation spatial. Several studies have linked socialization and exercise to the growth of Canine hippocampus, the brain area responsible for memory.

According to the authors, the canine hippocampus is a crucial brain structure in the system. The limbic system is responsible for memory consolidation, learning, and spatial navigation. In dogs, the hippocampus is proportionally smaller in humans than in humans, but crucial for cognitive function. and short-term and long-term memory. Environmental enrichment and exercise can increase their size and protect against dementia, while aging significantly reduces its neurogenesis.

3. MATERIALS AND METHODS

According to Gil (1999), conducting research is important and necessary because it investigates the world in which Human beings live, and so do human beings themselves. However, for him, research only exists with the support of Appropriate methodological procedures that allow for a closer approach to the object of study.

According to the author, there are two general types of reasons for proposing questions of Research: intellectual pursuits, based on the desire to know or understand, for the satisfaction of knowing. or to understand; the practices, based on the desire to know in order to become capable of doing something.

Year VI, v.1 2026 | Submission: 08/02/2026 | Accepted: 10/02/2026 | Publication: 12/02/2026
better or more efficiently.

Regarding the objective, the newlywed research had an exploratory nature, which according to the author is characterized by the lack of scientifically produced information that met the requirements.

The needs of the proposed research, which, within the scope of canine operations in a high-risk environment...

The more complex the problem, the more familiar one tends to become with it, with a view to making it...

It's not explicit, since there's nothing written institutionally on the subject, and little related research.

at the national level, thus configuring an Action Research project related to the study of memory.

olfactory sense of a dog detecting narcotic substances.

In the meantime, relevant bibliographic surveys were carried out, which aligns with what...

states that understanding bibliographic research as the survey of all existing literature...

published in the form of books, periodicals (magazines), theses, conference proceedings, where its purpose is

to provide the researcher with access to the literature produced on a given subject.

4. RESULTS AND DISCUSSION

According to Gage (2000), structurally, dogs possess brain regions correlated with memory.

similar to humans, as are some of the activation patterns of these areas. Just like in

In humans, the hippocampus in dogs is involved in converting experiences (short-term memories) into...

long-term memories, organizing and retrieving information, especially memories.

spatial and contextual.

According to Lopes (2019), the training of narcotics detection dogs is a process specialized training based on positive reinforcement and the animal's hunting instinct, where it learns to to associate the smell of the drug with the reward of a favorite toy.

According to the author, training begins in puppyhood and evolves in phases, focusing on...

Development of the bond between the dog and its handler. Puppies are exposed to various environments,

Sounds and people help develop confidence and a balanced temperament, essential for the job.

police officer.

Do Valle (2022) adds: the dog chooses a favorite toy, which becomes the main reward. Initially, the dog is encouraged to search for the toy visually and, progressively, The object is hidden in hard-to-reach places, encouraging the use of the sense of smell. And, consequently, of hippocampus, since at this stage the objective is to associate the odor with the preferred toy, or That is, the conditioning of canine memory.

Bazilio (2023) says that small quantities of the substance (such as marijuana, cocaine, or crack) They are placed in PVC pipes or boxes and attached to the toy. The dog is conditioned to Remember that the game he's hunting has the specific scent of the narcotic, without ever having come into contact with it. Direct contact with the substance. The training simulates real-life operational situations, such as bag searches,

Year VI, v.1 2026 | Submission: 08/02/2026 | Accepted: 10/02/2026 | Publication: 12/02/2026

Cars, boats, rooms, and large areas are used to challenge the dog's sense of smell and ensure accuracy.

Upon locating the substance, the dog is trained to give a specific indication, pointing to the...

The exact location of the odor. For the dog, the whole process is a big game, and finding the drug is the...

A way to win your favorite toy and the interaction with the driver, provided by the memory.

canine olfactory sense.

FINAL CONSIDERATIONS

Based on the research conducted, it can be concluded that the sense of smell is crucial for long-term memory. and guidance of dogs, primarily through stimulation of the canine hippocampus. Being It is proven that specific training on the odors of narcotics stimulates not only olfactory regions, but also hippocampal regions, as the animal's own behavior indicates. that police dogs are capable of storing information, creating associations, and even modifying behaviors based on their olfactory memory.

Therefore, stimulation of the hippocampus, combined with olfactory stimuli, ensures better improves the dog's olfactory memory performance, providing better results in detecting Narcotic substances that go beyond training for complex operational areas.

REFERENCES

AMAZONAS. Statute of the Military Police of the State of Amazonas. Law 1.154 of December 9th. 1975. **Official Gazette of the State of Amazonas**, Amazonas, AM. 1975.

BAZILIO, Bruno Tiemann. **Dog training and welfare in veterinary medicine**: a literature review. 2023.

BECK, Alan; KATCHER, Aaron. **Between Pets and People**: The importance of Animal Companionship. West Lafayette, Indiana: Purdue University Press, 2003.

BRAZIL. Constitution of the Federative Republic of Brazil. **Official Gazette of the Federative Republic of Brazil**, Brasília, DF. 1988.

_____. Law establishes the National System of Public Policies on Drugs - Sisnad. **Official Gazette [From the] Federative Republic of Brazil**, Brasília, DF. 2006.

DO VALLE, Vitor Batista. **The olfactory capacity and precision of dogs in the service of man**. Scientific Journal of the Higher School of Military Police, v. 3, n. 5, 2022.

GAGE, F. **Mammalian neural stem cells**. Science 2000;287:1433-1438.

GIL, Antonio Carlos. **Methods and techniques of social research**. 5th ed. São Paulo: Atlas, 1999.

Year VI, v.1 2026 | Submission: 08/02/2026 | Accepted: 10/02/2026 | Publication: 12/02/2026

GOULD, E., REEVES AJ. **Hippocampal neurogenesis in adult old world canines.** PNAS
1999;96:5263-5267.

LOPES, MLS **Selection and Training of Police Dogs.** Federal Rural University of Pernambuco,
Undergraduate Course in Animal Science. 2019.

MALHOTRA, Naresh. **Marketing research:** an applied orientation. 3rd edition. Porto Alegre: Bookman,
2001.

MARCONI, Marina de Andrade.; LAKATOS, Eva Maria. **Research techniques:** planning and execution
of research, sampling and research techniques, data preparation, analysis and interpretation. 3rd
edition. São Paulo: Atlas, 1996.

SELLTIZ, Jahoda Deutsch. **Research methods in social relations.** São Paulo: EPU, 1974.