

**EXPLORING THE BOUNDARIES OF HUMAN SECURITY. THE LEGAL AND
SCIENTIFIC DIMENSIONS OF SCENT DETECTION CANINES**

Abstract:	<i>As the literature review has shown, the legal debate for the use of scent detection canines is ongoing in all areas of life. There are no blanket acceptances for warrantless detection in public, such as vehicles or personal odor, as there are no blanket denials of regarding homes. Science is also an ongoing process to understand how the canine olfactory system works in detecting VOCs (volatile organic compounds) and how the canines discriminate odors. Human technology is currently not as sensitive as canines in detecting weathered traces of blood after long periods of time, so reliability questions will still arise. Studies and statistics on canine training and performance will need improvement to consistently stand up to Fry and Daubert reliability challenges.</i>
Keywords:	Legal; canine; detection; marijuana; odor; reliability
Contact details of the authors:	E-mail: andreea.dragomir@ulbsibiu.ro (1) i.florescu@ufl.edu (2)
Institutional affiliation of the authors:	Lucian Blaga University, School of Law (1) University of Florida, Maples Center for Forensic Medicine (2)
Institutions address:	Calea Dumbrăvii 34, Sibiu, Romania 550324 (1) University of Florida, 4800 SW 35th Drive, Gainesville, Florida 32608 (2)

Due to their superior olfactory system, canines are trained in scent detection and have been widely used in various industries, such as conservation, law enforcement, search and rescue, medicine, and the military. In some areas of their scent detection work, canines have become the subject of legal debate because of their unique abilities to identify illegal drugs, explosives and people based on their odors¹. Scent detection canines have also been involved in cadaver detection, scent lineups, personal sniffs and to form probable cause for forfeitures of currency tied to drug trafficking². Canine alerts to odors have been used by law enforcement to form reasonable suspicion and probable cause to further investigate vehicles and homes for various drugs³. As privacy interests have intensified in their last decades, the canine olfactory system and canine reliability have come into question due to a lack of scientific knowledge and lack of unified standards for canine and handler training and certification⁴.

The literature review will take a thematic approach, addressing seven major areas of legal debate to illustrate the use of scent detection canines in forensic science. The literature review will analyze 13 articles and books regarding canine odor detection in public, near private homes and protected curtilage, reliability challenges, human remain detection, human tracking, cocaine and currency forfeitures and cannabis legalization and decriminalization. Through scientific evidence and case law, the literature will highlight canine sniffs of vehicles, personal curtilage in public, differences between private homes and other modern homes, volatile organic compounds, body odor discrimination, discrimination between cocaine and snapdragon

¹ Tadeusz Jezierski, John Ensminger, LE Papet (Eds.), *Canine Olfaction Science and Law* (1sted.), CRC Press, 2016, pp. 215-222

² Carmen M. Cusack, *Animals and Criminal Justice* (1sted.), Routledge, New York, 2015, <https://doi.org/10.4324/9781315082301>, p. 56

³ *Ibidem*, p. 58

⁴ Kenneth G Furton, Norma Iris Caraballo, Michelle M Cerreta, Howard K Holness, *Advances in the use of odor as forensic evidence through optimizing and* –13, <http://www.jstor.org/stable/24505154>, DOI: 10.1098/rstb.2014.0262

flowers and the new challenges with cannabis legalization and decriminalization. Some questions will be answered while new ones will surface regarding reasonable suspicion, probable cause and reliability hearings involving scent detection canines. Lastly, the literature review will identify an immediate need for policy reform in the nationwide use of cannabis detection dogs, as legalization and decriminalization of medical and recreational marijuana has taken root among states and was recently passed in the House¹.

Literature review. Canine odor detection in public

The US Constitution, through the Fourth Amendment, grants people the right to be free against unreasonable search and seizure unless a warrant is issued based on probable cause or the search falls within a specific exception. The Supreme Court held that most drug detection canine sniffs located in a public area are not a search under the Fourth Amendment, therefore it is not necessary to justify or determine the admissibility of a warrantless canine alert because it's not a search². However, real world cases are not as plain as simple as that. In *US v Place*, 1983, luggage was seized for 90 minutes before the canine was deployed to conduct the sniff. The court reasoned that even though a brief seizure of property was supported by *Terry v Ohio*, in this case the delay was too long and violated the Fourth Amendment. In 1984, the court in *US v Jacobsen*, upheld warrantless field testing stating that individuals lack a legitimate expectation of privacy in possessing illegal contraband. Similarly, *Illinois v Caballes* in 2005 relying on *Place* and *Jacobsen* held that canine sniffs during lawful traffic stops did not violate the Fourth Amendment because there is no legitimate protected privacy interest in the possession of contraband. Furthermore, the *Caballes* court distinguished *Kyllo v US* because a canine sniff, unlike a thermal imaging device, cannot detect lawful activities³. Like *Place*, *Rodriguez v US* police had an extended stop, causing a 7- or 8-minute delay for the canine sniff and even though the delay was minimal it was deemed to violate the Fourth Amendment⁴.

In canine vehicle sniff instances without probable cause, canines entering the vehicle while performing the sniff violates the Fourth Amendment as shown by *US v Willingham*, 1998, unless the entry was instinctual and not trained (*US v Vazquez*, 2009⁵ and *US v Sharpe*, 2012⁶).

Smith provides other examples of canine sniffs in public areas that were not deemed to be a search to necessitate probable cause and a warrant. They include canine sniff outside trailer facility (*US v Ibarra*, 1991⁷), hotel room door (*US v Roby*, 1997⁸ and *US v Marlar* 1993⁹), school lockers (*Horton v Goose Creek Indep. Sch. Dist.*¹⁰) and rail sleeper compartment (*US v Colyer*¹¹).

¹ Morgan Smith, *Beware of the drug detection dog: the fourth amendment, drug detection dogs, and state legalization of marijuana*, "SMU Law Review", Vol. 73, No. 3, 2020, pp. 611-636 <https://scholar.smu.edu/smulr/vol73/iss3/11/> (24.03.2024)

² Carmen M. Cusack, *Animals and Criminal Justice* (1st ed.), Routledge, New York, 2015, <https://doi.org/10.4324/9781315082301>, p. 65

³ Morgan Smith, *Beware of the drug detection dog: the fourth amendment, drug detection dogs, and state legalization of marijuana*, "SMU Law Review", Vol. 73, No. 3, 2020, pp. 611-636, <https://scholar.smu.edu/smulr/vol73/iss3/11/> (24.03.2024)

⁴ *Ibidem*, p. 8

⁵ United States Court of Appeals, Tenth Circuit, *United States of America, Plaintiff-Appellee, v. Juan Antonio VAZQUEZ, Defendant-Appellant*, No. 08-4044, <https://caselaw.findlaw.com/court/us-10th-circuit/1025922.html> (24.03.2024)

⁶ United States Court of Appeals, Sixth Circuit, *United States of America, Plaintiff-Appellee, v. David W. SHARP, Defendant-Appellant*, No. 10-6127, <https://caselaw.findlaw.com/court/us-6th-circuit/1607477.html> (25.03.2024)

⁷ U.S. Supreme Court, *United States v. Ibarra*, 502 U.S. 1 (1991), No. 90-1713, <https://supreme.justia.com/cases/federal/us/502/1/> (25.03.2024)

⁸ United States Court of Appeals, Eighth Circuit, *United States of America, Appellee, v. Kevin Anthony ROBY, Appellant*, No. 97-1051, <https://caselaw.findlaw.com/court/us-8th-circuit/1004707.html> (25.03.2024)

⁹ U.S. District Court for the Northern District of Mississippi, *United States v. Marlar*, 828 F. Supp. 415, N.D. Miss. 1993 August 9, <https://law.justia.com/cases/federal/district-courts/FSupp/828/415/2352244/> (25.03.2024)

¹⁰ United States Court of Appeals, Fifth Circuit, *Horton v. Goose Creek Independent School Dist.*, 677 F.2d 471 (5th Cir. 1982), <https://casetext.com/case/horton-v-goose-creek-independent-school-dist> (25.03.2024)

¹¹ United States Court of Appeals, District of Columbia Circuit, *U.S. v. Colyer*, 878 F.2d 469 (D.C. Cir. 1989), <https://casetext.com/case/us-v-colyer> (25.03.2024)

Personal curtilage in public

Ferguson in 2014 defines the theory of personal curtilage as a person's protected area in public intended to be secure from intrusion by others using sense enhancing technologies. Traditionally curtilage was applied to against helicopter surveillance (*Florida v Riley*¹ and *California v Ciraolo*²), wiretap (*Katz v US*³), GPS monitoring (*US v Jones*⁴) and thermal imaging (*Kyllo v US*⁵). Personal curtilage borrows from these cases and needs to demonstrate a relation to intimate or personal information. Just as the traditional sense enhancing technologies, odor detection canines don't require physical intrusion and if a person can demonstrate a space to be personal curtilage, an invasion without a warrant could violate the Fourth Amendment⁶.

One of the personal curtilage interests people seek to protect is odor. Courts have ruled that a "plain smell" can be used to develop reasonable suspicion and probable cause and it is not considered a search under the Fourth Amendment. As mentioned earlier, a canine sniff of luggage and cars does not constitute a search⁷, however there is debate whether canine sniff of a person can constitute a search if it's invasive enough. *Doe v Renfrow*, 1980⁸ found that a proximity suspicion less canine sniff was not a search, but *Horton v. Goose Creek Independent School District*, 1982⁹, on the contrary found the proximity sniff to be offensive. In *US v Kelly* 2002¹⁰, a canine sniff that contacted the person was deemed to be a search, but *Illinois v Caballes*¹¹ illustrated that no legitimate privacy interest existed in the possession of contraband and the sniff did not intrude on a protected privacy interest¹². In *US v Reyez* 2003¹³, the court upheld the canine sniff and alert from four to five feet away and similarly, in *Jones v Texas* 2015¹⁴, the court upheld the canine sniff and found that non-contact sniff was only minimally intrusive.

However, the theory of personal curtilage may be applicable to whether an area may be defended against surveillance by using masking agents. In *Florida v Jardines*, the defendant covered his house in mothball smell to mask the odor of marijuana. Detector canines alerted to marijuana on the front porch. Even though the case was resolved under the protected curtilage, it could be asserted that by using masking agents, *Jardines* indicated a desire to protect against sniffing and inspection so under Ferguson's in 2014 theory, *Jardines* would be protected in this regard as well.

¹ U.S. Supreme Court, *Florida v. Riley*, 488 U.S. 445 (1989), No. 87-764, <https://supreme.justia.com/cases/federal/us/488/445/> (25.03.2024)

² U.S. Supreme Court, *California v. Ciraolo*, 476 U.S. 207 (1986), No. 84-1513, <https://supreme.justia.com/cases/federal/us/476/207/> (25.03.2024)

³ U.S. Supreme Court, *Katz v. United States*, 389 U.S. 347 (1967), No. 35, <https://supreme.justia.com/cases/federal/us/389/347/> (25.03.2024)

⁴ United States Court of Appeals for the District of Columbia Circuit, *United States v. Jones*, 565 U.S. 400 (2012), No. 10-1259, <https://supreme.justia.com/cases/federal/us/565/400/> (01.04.2024)

⁵ Certiorari to the United States Court Of Appeals For The Ninth Circuit, *Kyllo v. United States*, 533 U.S. 27 (2001), No. 99-8508, <https://supreme.justia.com/cases/federal/us/533/27/> (01.04.2024)

⁶ Andrew Guthrie Ferguson, *Personal curtilage: fourth amendment security in public*, William&Mary Law Review, 55(4), 2014, pp. 1283-1364, <https://scholarship.law.wm.edu/wmlr/vol55/iss4/2/> (01.04.2024)

⁷ Tadeusz Jezierski, John Ensminger, LE Papet (Eds.), *Canine Olfaction Science and Law* (1st ed.), CRC Press, 2016, pp. 215-222.

⁸ United States Court of Appeals, *Seventh Circuit, Doe v. Renfrow*, 631 F.2d 91 (7th Cir. 1980), <https://casetext.com/case/doe-v-renfrow-2> (01.04.2024)

⁹ United States Court of Appeals, *Fifth Circuit, Horton v. Goose Creek Independent School Dist*, 677 F.2d 471 (5th Cir. 1982), <https://casetext.com/case/horton-v-goose-creek-independent-school-dist> (01.04.2024)

¹⁰ United States Court of Appeals, Fifth Circuit, *United States of America, Plaintiff-Appellee, v. James Patrick Kelly, Defendant-Appellant.*, No. 01-40467, <https://caselaw.findlaw.com/court/us-5th-circuit/1156105.html> (01.04.2024)

¹¹ Supreme Court of The United States, *Illinois V. Caballes*, 543 U.S. 405 (2005) No. 03-923, <https://supreme.justia.com/cases/federal/us/543/405/> (01.04.2024)

¹² Andrew Guthrie Ferguson, *Personal curtilage: fourth amendment security in public*, William&Mary "Law Review", Vol. 55, No. 4, 2014, pp. 1283-1364, <https://scholarship.law.wm.edu/wmlr/vol55/iss4/2/> (01.04.2024)

¹³ United States Court of Appeals, Second Circuit, *US v. Ramon Reyes*, No. 03-1119, <https://caselaw.findlaw.com/court/us-2nd-circuit/1423190.html> (01.04.2024)

¹⁴ Court Of Appeals Second District of Texas Fort Worth, *Jones v. State*, No. 02-14-00073-CR (Tex. App. Jan. 8, 2015), No. F-2013-1447-A, <https://casetext.com/case/jones-v-state-5552> (01.04.2024)

Homes and protected curtilage

Florida v Jardines in 2013¹ is the first recent case to apply strict standards towards canine sniffs of a private home. After an unverified tip, the canine sniff was performed on the defendant's front porch. The positive alert was used to secure a search warrant, which turned up a marijuana growing operation in the house. The court relied on US v Jones in 2012² to rule that the canine sniff in this case was a search because it was a physical intrusion of curtilage³. The court also held that a police officer has implied license to walk up to the door by the prescribed path to engage the resident, but it's not customary to introduce a detection canine to explore the area⁴. However, not all homes are given the same protection. In North Dakota v Nguyen in 2013⁵, the court upheld a warrantless canine sniff of a common area of an apartment building because there is not a legitimate expectation of privacy in the hallways.

Connor also illustrates that recent case have further addressed questions of protected curtilage when dealing with canine sniffs of modern home designs. While the area outside an apartment is not considered curtilage in Lindsey v Maryland, 2015⁶, underneath an apartment window is a protected area according to US v Burston, 2015⁷. An apartment staircase and landing are also not deemed curtilage (US v Bain, 2015⁸), but it was said that a small apartment building with a locked front door may have a higher expectation of privacy than a large building without a lock. In US v Soza, 2016⁹, the court regarded the condominium porch like a single-family home porch as opposed to a common hallway of an apartment building, giving it protection¹⁰.

A townhouse designed with exterior doors instead of an indoor hallway is also treated as protected curtilage. US v Hopkins in 2016¹¹ used the Dunn test (proximity to home, area within enclosure of home, nature of use and steps taken to protect area from observers) to establish the area 6-8 feet in front of the unshared exterior door as curtilage¹². US v Whitaker, 2016¹³, took a different approach to canine sniffs of an area at the front door of an apartment. Judge Kagan based her decision not on curtilage protection, but she took the Kyllo approach (enhancement device not available to the public) to contend that common areas of an apartment building provide an intermediate level of privacy and residents have a right to expect certain norms of behavior in the hallway, which doesn't include a warrantless canine sniff. This decision, however, does not

¹ Supreme Court of The United States, *Florida V. Jardines*, No. 11–564, 569 U.S. 1 (2013), <https://supreme.justia.com/cases/federal/us/569/1/> (01.04.2024)

² Supreme Court of The United States, *United States v. Jones*, 565 U.S. 400 (2012), No. 10-1259, <https://supreme.justia.com/cases/federal/us/565/400/> (01.04.2024)

³ *Ibidem*, p. 8.

⁴ Eric Connon, *Growing Jardines: Expanding Protections against Warrantless Dog Sniffs to Multiunit Dwellings*, "Case Western Reserve Law Review", Vol. 67, No. 1, 2016, pp.309-315 <https://scholarlycommons.law.case.edu/caselrev/vol67/iss1/13> (10.04.2024),

⁵ Supreme Court State Of North Dakota 2014 Nd 211, *State of North Dakota v. Matthew D. Nguyen*, No. 20140183, <https://law.justia.com/cases/north-dakota/supreme-court/2014/20140183.html> (10.04.2024)

⁶ Court of Special Appeals of Maryland, *Shaun D. Lindsey V. State of Maryland*, No. 0146, <https://caselaw.findlaw.com/court/md-court-of-special-appeals/1721054.html> (10.04.2024)

⁷ United States Court of Appeals, Eighth Circuit, *United States of America, v. Democrus Pernell Burston*, No. 14–3213, <https://caselaw.findlaw.com/court/us-8th-circuit/1719311.html> (12.04.2024)

⁸ United States District Court, D. Massachusetts, *United States v. Bain*, 155 F. Supp. 3d 107 (D. Mass. 2015), No. 14-10115, <https://casetext.com/case/united-states-v-bain-8> (12.04.2024)

⁹ United States Court of Appeals, Fifth Circuit, *United States of America, v. Darrin Antonio Soza*, No. 16-41689, <https://caselaw.findlaw.com/court/us-5th-circuit/1878610.html> (12.04.2024)

¹⁰ Eric Connon, *Growing Jardines: Expanding Protections against Warrantless Dog Sniffs to Multiunit Dwellings*. Case Western Reserve Law Review, Vol. 67, No. 1, 2016, pp.309-315, <https://scholarlycommons.law.case.edu/caselrev/vol67/iss1/13> (12.04.2024)

¹¹ United States Court of Appeals, Eighth Circuit, *United States v. Hopkins*, 824 F.3d 726 (8th Cir. 2016), <https://casetext.com/case/united-states-v-hopkins-124> (12.04.2024)

¹² Eric Connon, *Growing Jardines: Expanding Protections against Warrantless Dog Sniffs to Multiunit Dwellings*. Case Western Reserve Law Review, Vol. 67, No. 1, 2016, pp.309-315, <https://scholarlycommons.law.case.edu/caselrev/vol67/iss1/13> (12.04.2024)

¹³ United States Court of Appeals, Seventh Circuit, *United States of America, Plaintiff–Appellee, v. Lonnie Whitaker*, Nos. 14–3290, 14–3506, <https://caselaw.findlaw.com/court/us-7th-circuit/1731606.html> (12.04.2024)

change precedent because the Supreme Court differentiated between thermal imaging in *Kyllo*, which can detect lawful activity, and a canine sniff in *Place*, which only detects illegal contraband¹.

Human remain detection (HRD canines)

Canines trained in HRD can detect minute traces of blood, bone, fat, teeth and cadaver odor even when area and objects have been weathered or cleaned. HRD canines have been used by police in the US since 1974. More recently, training using the Scent Transfer Unit (STU-100) has yielded 90% response using different concentrations and different decomposition target odors². However, the HRD canine's scientific reliability comes into question in court when no remains can be located or confirmed at the alert site³. The canine olfactory system can detect volatile organic compounds (VOCs) to identify a particular source of odor, although it is not yet determined whether canines are alerting to a single compound, a compound class, or the entire odor profile⁴. The most recent studies in VOC profiles of human remains, animal remains, and live humans found definite distinguishable features in the profiles. However, it was found that for weathered latent blood, chemical presumptive tests with comprehensive two-dimensional gas chromatography (GC×GC) and luminol could not replicate the reported sensitivity of canines. Furthermore, current analytical instruments for blood detection found no blood traces on weathered porous and non-porous surfaces after two months⁵. This suggests that traces found by canines after two months without remains cannot be verified by current technology and may be questioned in court.

A lack of research exists regarding whether individual blood has a unique odor and in analysis of blood in forensics to provide insight about the effects of VOC profiles as blood decomposes. Scientific reliability requires data supporting the canine's sensitivity (odor concentration or threshold) and specificity (locating target odor only). These are often produced from training records, assessments, and certifications⁶. In 2007 HRD canines were taken to places the suspect visited and alerted to residual cadaver odor, but no remains were found. The court denied the admission of cadaver canine evidence because while it was relevant, the canines were not found to be reliable at alerting to human remains⁷. In a similar case, the 2007 *Trejos v Texas*⁸ case, the reliability of the canine was examined for whether the breed worked well off-lead, was trained to discriminate between human and animal scents and whether the canine's experience proved he was reliable. The discussion was based on the canine training records, certifications, past performance, the handler's testimony, the search method and whether the evidence was unfairly prejudiced since not a body was found. The court admitted the evidence because the canines worked independently and off-lead, and their records proved their reliability⁹. In the 2015 *California v. Herring*¹⁰ and 2015 *US v Burgos Montes*¹¹ the canines

¹ Eric Connon, *Growing Jardines: Expanding Protections against Warrantless Dog Sniffs to Multiunit Dwellings*, "Case Western Reserve Law Review", Vol. 67, No. 1, 2016, pp. 309-315, <https://scholarlycommons.law.case.edu/caselrev/vol67/iss1/13> (12.04.2024)

² Paola A. Prada, Allison M. Curran, Kenneth G. Furton, *Human Scent Evidence* (1st ed.), CRC Press, 2014, p. 98, <https://doi.org/10.1201/b17469> (12.04.2024)

³ Lauryn E. DeGreeff, Craig A. Schultz (Eds.). *Canines: The Original Biosensors* (1st ed.), Jenny Stanford Publishing, 2022, p. 255, <https://doi.org/10.1201/9781003261131> (12.04.2024)

⁴ *Idem*

⁵ *Idem*

⁶ *Idem*

⁷ Tadeusz Jezierski, John Ensminger, LE Papet (Eds.), *Canine Olfaction Science and Law* (1st ed.), CRC Press, 2016, pp. 215-222

⁸ Court of Appeals of Texas, Houston (14th Dist.), *Roberto Yarit Trejo, v. The State of Texas*, No. 14-06-00168-Cr, <https://caselaw.findlaw.com/court/tx-court-of-appeals/1180978.html> (13.04.2024)

⁹ Susan M. Stejskal, *Death, Decomposition, and Detector Dogs: From Science to Scene* (2nd ed.). CRC Press, 2022, pp. 5-29, <https://doi.org/10.4324/9781003217251> (13.04.2024)

¹⁰ United States District Court Northern District of California, *People v. Herring*, No. B249468 (Cal. Ct. App. Apr. 22, 2015), <https://casetext.com/case/people-v-herring-104> (13.04.2024)

¹¹ United States Court of Appeals, First Circuit, *United States of America, v. Edison Burgos-Montes*, No. 13-2305, <https://caselaw.findlaw.com/court/us-1st-circuit/1700881.html> (13.04.2024)

alerted to human remains, but no remains were subsequently found. In both cases the canine evidence was corroborated by other evidence and the convictions were upheld¹.

Tracking canines

For tracking purposes, scent detection canines are trained to differentiate and discriminate the body odor trail of identical twins on the same path. To collecting human scent evidence for target odors, there are currently four methods: canine smelling article directly, direct wiping with sterile gauze, headspace absorption (non-contact method using sorbent material directly on object and both wrapped in aluminum foil for scent enhancement) and Scent Transfer Unit (STU-100) (a portable vacuum through sterile gauze pads). Caution must be taken in collection procedures to avoid contamination of source scent in direct approaches². Research in human scent shows that personal odor originates from bacterial flora, unique biological processes, and a variation of lifestyle factors. Further questions arise regarding the effect of body odor has on the decaying VOC profile³ and the length of time odors remain at the source. In *California v Gutierrez, 2007*⁴, the scent detection canine evidence was deemed inadmissible because the canine was deployed after 6 days of the crime, which was deemed less reliable than more immediate searches and the canine certification procedures were deemed inadequate to show reliability⁵.

Currency forfeitures

The foundation of forfeitures of illicit currency requires probable cause demonstrated by the relationship of the currency to drug trafficking, based on *US v Dickerson, 1988*,⁶ and an aggregate of facts linking the currency to drug trafficking, based on *US v \$215,300 in 1989*⁷. The court in the 1988 case *US v \$83,310.78*⁸ found an aggregate of facts to support the detection dog by the suspect's two prior convictions and drug possession charges⁹. The standards are a considerable challenge when currency and drugs are not found together. Scent detection dogs were employed to find the association, but challenges to the reliability of their alert emerged with findings that most circulating banknotes contain traces of cocaine.

In *US v \$30,060, 1994*¹⁰, a narcotics detection canine alerted to the suspect's money, but a follow up search did not find drugs. The court ruled the canine provided strong evidence but insufficient to establish probable cause after the forensic toxicologist testified that 75% currency in LA contained minute traces of cocaine. Similarly, the court in the 2003 case *US v \$62,552*¹¹ found that a substantial connection was not established by a preponderance of evidence. Recent research has focused on finding the mathematical likelihood that circulating currency is more highly contaminated with cocaine than the general minute level.

¹ Tadeusz Jezierski, John Ensminger, LE Papet (Eds.), *Canine Olfaction Science and Law* (1st ed.), CRC Press, 2016, pp. 215-222

² Paola A. Prada, Allison M. Curran, Kenneth G. Furton, *Human Scent Evidence* (1st ed.), CRC Press, 2014, p. 98, <https://doi.org/10.1201/b17469> (13.04.2024)

³ Lauryn E. DeGreeff, Craig A. Schultz (Eds.), *Canines: The Original Biosensors* (1st ed.). Jenny Stanford Publishing, 2022, p. 255, <https://doi.org/10.1201/9781003261131>, (13.04.2024)

⁴ California Court of Appeals, Second District, Fifth Division, *People v. Gutierrez*, No. B195786 (Cal. Ct. App. Dec. 27, 2007), <https://casetext.com/case/people-v-gutierrez-566> (13.04.2024)

⁵ Tadeusz Jezierski, John Ensminger, LE Papet (Eds.), *Canine Olfaction Science and Law* (1st ed.), CRC Press, 2016, pp. 215-222

⁶ Eschbach, Senior Circuit Judge, *United States v. Dickerson*, 857 F.2d 414 (1988), No. 87-3138, <https://www.anylaw.com/case/united-states-v-dickerson/seventh-circuit/09-14-1988/4IZiP2YBTITomsSBZXII> (13.04.2024)

⁷ United States Court of Appeals, Ninth Circuit, *U.S. v. \$215,300 U.S. Currency*, 882 F.2d 417 (9th Cir. 1989), No. 87-5826, <https://casetext.com/case/us-v-215300-us-currency> (13.04.2024)

⁸ United States Court of Appeals, Ninth Circuit, *U.S. v. U.S. Currency \$83,310.78*, 851 F.2d 1231 (9th Cir. 1988), No. 87-1853, <https://casetext.com/case/us-v-us-currency-8331078> (13.04.2024)

⁹ Tadeusz Jezierski, John Ensminger, LE Papet (Eds.), *Canine Olfaction Science and Law* (1st ed.), CRC Press, 2016, pp. 215-222

¹⁰ United States Court of Appeals, Ninth Circuit, *U.S. v. U.S. Currency*, 39 F.3d 1039 (9th Cir. 1994), No. 92-55919, <https://casetext.com/case/us-v-us-currency-3006000>, (13.04.2024)

¹¹ United States District Court, D. Kansas, *U.S. v. Culpepper*, No. 03-40086-01-SAC (D. Kan. Oct. 14, 2003), <https://casetext.com/case/us-v-culpepper-4> (13.04.2024)

Evaluating the level of cocaine contamination on the currency may satisfy the evidence requirement in future cases¹. In *US v \$100,120*², the threshold of methyl benzoate, the active odor of cocaine, was questioned. Considering earlier studies, was deemed that enough cocaine residue would last longer than 48 hours. Unfortunately, the amount of cocaine on the currency could not be established because the money was deposited into a bank³.

Reliability challenges

In *Florida v Jardines*⁴, an amici curiae brief called into question the selectivity and reliability of canines. They highlighted the fact that canines alert to methyl benzoate, the active odor of cocaine, not the contraband itself. Methyl benzoate is also found in common items such as snapdragon flowers, so it was proposed that canine cannot distinguish the cocaine reliably⁵. Studies by Fulon in 1997, 2002 and Cerreta and Fulton in 2014 assessed the canine's ability to distinguish between the odor of cocaine and snapdragon flowers and discovered that canines were able to discriminate between the two. Fulton also stated that most canines were even able to discriminate against pharmaceutical grade cocaine. In the 2014 study, 21 scent detection canine teams were presented with potted and cut snapdragon flowers and none of the canines alerted to the flowers. Cocaine was used as the control, to which all the canines alerted, proving that trained canines can distinguish cocaine's odor profile. Component analysis of the snapdragon flower at various stages of life, showed that other compounds contribute significantly more than methyl benzoate to the flower's odor profile⁶.

In *Florida v Harris*, 2013⁷, the Supreme Court examined how courts should determine a canine's reliability to establish probable cause. The court considers the dog's certification, training records and field performance records if available to establish reliability. The court established that challenges may be raised based on the adequacy of the training and certification, the canine and handler's performance in assessments. The court does not require field records but allows the defense to question handler about the canine's field accuracy. It was established that during probable cause hearings, the government would introduce evidence of canine's certification and training, which the defense may challenge, and the judge would weigh the competing evidence and the totality of circumstances through common sense. Standardization guidelines and scientific research for canine programs are more imperative than ever before if canine scent detection reliability is to stand up to Frye and Daubert challenges. The National Institute of Justice (NIJ) initiated through the Scientific Working Group on Dog and Orthogonal Detector Guidelines (SWGDOG) the creation of nationwide practical guidelines. Aside from standard training guidelines, recent research into the Universal Detector Calibrant (UDC) proposes the new training aid for early olfactory enrichment to stimulate positive behaviors. It is also useful for nonspecific detection training before the canine is assigned a scent disciple and requires no extinction training. The UDC can be controlled for various sensitivity and thresholds and can assist handlers in canine selection⁸.

Marijuana legalization and decriminalization

¹ Tadeusz Jezierski, John Ensminger, LE Papet (Eds.), *Canine Olfaction Science and Law* (1st ed.), CRC Press, 2016, pp. 215-222

² Federal Courts District Courts, Northern District of Illinois, *USA v. \$100120 US Currency, No. 1:2003cv03644 - Document 219 (N.D. Ill. 2011)*, <https://law.justia.com/cases/federal/district-courts/illinois/ilndce/1:2003cv03644/135030/219/> (15.04.2024)

³ Tadeusz Jezierski, John Ensminger, LE Papet (Eds.), *Canine Olfaction Science and Law* (1st ed.), CRC Press, 2016, pp. 215-222

⁴ U.S. Supreme Court, *Florida v. Jardines*, 569 U.S. 1 (2013), No. 11-564, <https://supreme.justia.com/cases/federal/us/569/1/> (15.04.2024)

⁵ Michelle M Cerreta, Kenneth G Furton, *An Assessment of Detection Canine Alerts Using Flowers That Release Methyl Benzoate, the Cocaine Odorant, and an Evaluation of Their Behavior in Terms of the VOC's Produced*, Forensic Science International, Elsevier, 2015, <http://dx.doi.org/10.1016/j.forsciint.2015.03.021>. (15.04.2024)

⁶ *Idem*

⁷ U.S. Supreme Court, *Florida v. Harris*, 568 U.S. 237 (2013), No. 11-817, <https://supreme.justia.com/cases/federal/us/568/237/> (15.04.2024)

⁸ Michele N. Maughan, Jenna D. Gadberry, Caitlin E. Sharpes, Patricia E. Buckley, Aleksandr E. Miklos, Kenneth G. Furton, Lauryn E. DeGreeff, Nathaniel J. Hall, Robin R Greubel, Katylynn B. Sloan, *Calibrating Canines - A Universal Detector Calibrant for Detection Dogs*, "Front. Allergy, 12 March 2024, Sec. Rhinology", Vol. 5, 2024, <https://doi.org/10.3389/falgy.2024.1366596> (15.04.2024)

States have begun to legalize marijuana in small quantities for medical use and for recreational use, while some states have only decriminalized marijuana, but currently the federal government still considers it a crime. Considering these changes, the continued use of detection canines trained to target marijuana, may open the government for challenges based on the premise was that detection dogs could only detect illegal contraband. It may become easier to associate marijuana detection canine to the thermal imaging in *Kyllo*, since in states where the law has changed the canines will no longer be able to discriminate legal from illegal substances¹. In the Colorado case, *People v McKnight*, 2019², the substance involved was not marijuana, but the canine involved was trained to detect several substances including marijuana, which became legal. The challenge was since a minute amount of marijuana would have caused the canine to alert in the same way as if the scent was meth. The court recognized that although guns and alcohol can be unlawful in some instances, people expect privacy in lawful possession of those items, and it should be the same for marijuana³.

Decriminalization of marijuana also poses a problem such as in *Pacheco v Maryland*, 2019⁴, where possession of less than 10 once became a civil offense instead of a criminal offense. The question was whether possession of less than 10 once was probable cause that the person possessed more than 10 once. The court answered in a negative. In Texas, one of the stricter marijuana states, legalized hemp, which is 3% THC and inadvertently changed the way canine investigations would be conducted. Neither crime labs nor canines can differentiate between hemp and marijuana in higher concentrations, so Texas may be headed in the same direction as *McKnight*⁵.

Currently, HR 3617, the Marijuana Opportunity Reinvestment and Expungement Act (MORE) has passed in the House⁶. The bill would remove marijuana from the list of schedule substances and eliminate criminal penalty for manufacturing, distributing, and possessing marijuana, which would change the entire way the nations conduct scent detection with canines trained in marijuana detection.

Conclusions

Canine odor detection in public spaces plays a significant role in crime prevention and resolution, contributing to human security. The Fourth Amendment of the U.S. Constitution safeguards citizens from unreasonable searches and seizures, necessitating a delicate balance between effective law enforcement and individual privacy rights. Supreme Court rulings have generally deemed canine sniffs in public areas as non-intrusive under the Fourth Amendment, allowing them to be conducted without a warrant. However, real-world applications reveal complexities that challenge this straightforward interpretation.

Several landmark cases highlight the nuances in canine odor detection jurisprudence. In *U.S. v. Place*, 1983 and *Rodriguez v. U.S.*, 2015, the courts emphasized that extended delays in canine sniffs could constitute unreasonable seizures, violating the Fourth Amendment. Conversely, cases like *Illinois v. Caballes*, 2005 upheld that canine sniffs during lawful traffic stops do not infringe on privacy rights, as individuals do not have a legitimate expectation of privacy in illegal contraband.

The concept of *personal curtilage* further complicates the legality of canine sniffs in public spaces. Traditionally applied to home environments, this concept can extend to areas in public where individuals have a reasonable expectation of privacy. For instance, *Florida v. Jardines*, 2013, recognized the area immediately surrounding a home as protected curtilage, thus requiring a warrant for a canine sniff. This protection,

¹ Eric Connon, *Growing Jardines: Expanding Protections against Warrantless Dog Sniffs to Multiunit Dwellings*, Case Western Reserve Law Review, Vol. 67, No. 1, 2016, pp.309-315 <https://scholarlycommons.law.case.edu/caselrev/vol67/iss1/13> (20.04.2024)

² Supreme Court of Colorado, *The People of the State of Colorado v. Kevin Keith McKnight*, No. 17SC584, <https://caselaw.findlaw.com/court/co-supreme-court/1999220.html> (20.04.2024)

³ Morgan Smith, *Lingsbeware of the Drug Detection Dog: The Fourth Amendment, Drug Detection Dogs, and State Legalization of Marijuana*, "SMU Law Review", Vol. 73, No. 3, 2020, pp. 611-636, <https://scholar.smu.edu/smulr/vol73/iss3/11/> (20.04.2024)

⁴ Maryland Supreme Court Decisions, *Michael Pacheco v. State of Maryland*, No. 17, 2019, <https://law.justia.com/cases/maryland/court-of-appeals/2019/17-18.html> (20.04.2024)

⁵ Morgan Smith, *Abeware of the Drug Detection Dog: The Fourth Amendment, Drug Detection Dogs, and State Legalization of Marijuana*, "SMU Law Review", Vol. 73, No. 3, 2020, pp. 611-636, <https://scholar.smu.edu/smulr/vol73/iss3/11/> (20.04.2024)

⁶ *Idem*

however, does not uniformly apply to all residential settings, as seen in *North Dakota v. Nguyen*, 2013, and *U.S. v. Bain*, 2015, where common areas in apartment buildings were not afforded the same privacy expectations.

The reliability and scientific credibility of canine detections are crucial, especially in sensitive applications like Human Remains Detection (HRD) and currency forfeitures. While HRD canines have shown remarkable abilities to detect traces of human remains, their alerts must be corroborated by additional evidence due to challenges in scientific validation and potential for false positives. In currency forfeitures, the presence of drug residues on commonly circulated currency complicates the establishment of probable cause, as demonstrated in *U.S. v. \$30,060*, 1994.

The evolving legal landscape regarding marijuana legalization poses additional challenges for canine odor detection. As seen in *People v. McKnight*, 2019 and *Pacheco v. Maryland*, 2019, changes in marijuana laws necessitate reevaluation of canine alerts as potential probable cause, given that canines cannot distinguish between legal and illegal substances.

To ensure the effectiveness and legality of canine odor detection in public, it is imperative to adopt standardized training and certification protocols, supported by robust scientific research. This approach would address concerns regarding the reliability and specificity of canine alerts, reinforcing their role in safeguarding human security while respecting constitutional rights. The development and implementation of guidelines by bodies like the National Institute of Justice (NIJ) and the Scientific Working Group on Dog and Orthogonal Detector Guidelines (SWGDOG) are steps in the right direction.

In conclusion, while canine odor detection remains a valuable tool in crime prevention and resolution, it must be carefully regulated to align with constitutional protections and evolving societal norms. Balancing the need for security with the preservation of individual rights will ensure the continued legitimacy and effectiveness of this practice.

Bibliography

Books and Articles

1. Cerreta, Michelle M.; Furton Kenneth G., *An Assessment of Detection Canine Alerts Using Flowers That Release Methyl Benzoate, the Cocaine Odorant, and an Evaluation of Their Behavior in Terms of the VOC's Produced*, Forensic Science International, Elsevier, 2015
2. Connon, Eric, *Growing Jardines: Expanding Protections Against Warrantless Dog Sniffs to Multiunit Dwellings*, "Case Western Reserve Law Review", Vol. 67, No. 1, 2016
3. Cusack, Carmen, M., *Animals and Criminal Justice* (1sted.), Routledge, New York, 2015
4. DeGreeff, Lauryn, E.; Schultz, Craig, A. (Eds.), *Canines: The Original Biosensors* (1sted.), Jenny Stanford Publishing, 2022
5. Ferguson, Andrew, Guthrie, *Personal Curtilage: Fourth Amendment Security in Public*, "William&Mary Law Review", Vol. 55, No. 4, 2014
6. Furton, Kenneth, G.; Norma, Iris, Caraballo; Michelle, M., Cerreta; Howard, K., Holness, *Advances in the Use of Odour as Forensic Evidence through Optimizing and Standardizing Instruments and Canines*, *Philosophical Transactions*, Biological Sciences, 2015
7. Jezierski, Tadeusz; Ensminger, John; LE, Papet (Eds.), *Canine Olfaction Science and Law* (1sted.), CRC Press, 2016
8. Maughan, Michele, N.; Gadberry, Jenna. D.; Sharpes, Caitlin, E.; Buckley, Patricia, E.; Miklos, Aleksandr, E.; Kenneth, Furton, G.; DeGreeff, Lauryn, E., Hall, Nathaniel, J.; Greubel, Robin, R.; Sloan, Katylynn, B.; *Calibrating Canines a Universal Detector Calibrant for Detection Dogs*, *Front. Allergy*, "Rhinology", Vol. 5, 2024
9. Prada, Paola, A.; Curran, Allison, M.; Furton, Kenneth G., *Human Scent Evidence* (1st ed.). CRC Press, 2014
10. Smith, Morgan, *Beware of the Drug Detection Dog: The Fourth Amendment, Drug Detection Dogs, and State Legalization of Marijuana*, "SMU Law Review", Vol. 73, No. 3, 2020
11. Stejskal, Susan, M., *Death, Decomposition, and Detector Dogs: From Science to Scene* (2nd ed.). CRC Press, 2022

Documents

1. Court of Appeals for California, Second District, Fifth Division, *People v. Gutierrez*, No. B195786 (Cal. Ct. App. Dec. 27, 2007)
2. Court Of Appeals For The Ninth Circuit, *Kyllo v. United States*, 533 U.S. 27 (2001), No. 99-8508, <https://supreme.justia.com/cases/federal/us/533/27/>
3. Court of Appeals of Texas, Houston (14th Dist.), *Roberto Yarit Trejo, V. The State Of Texas*, No. 14-06-00168-Cr, <https://caselaw.findlaw.com/court/tx-court-of-appeals/1180978.html>
4. Court Of Appeals Second District Of Texas Fort Worth, *Jones v. State*, NO. 02-14-00073-CR (Tex. App. Jan. 8, 2015), No. F-2013-1447-A, <https://casetext.com/case/jones-v-state-5552>
5. Court of Special Appeals of Maryland, *Shaun D. Lindsey V. State of Maryland*, No. 0146, <https://caselaw.findlaw.com/court/md-court-of-special-appeals/1721054.html>
6. Eschbach, Senior Circuit Judge, *United States v. Dickerson*, 857 F.2d 414 (1988), No. 87-3138, <https://www.anylaw.com/case/united-states-v-dickerson/seventh-circuit/09-14-1988/4IZiP2YBTITomsSBZXII>
7. Federal Courts District Courts, Northern District of Illinois, *USA v. \$100120 US Currency*, No. 1:2003cv03644 - Document 219 (N.D. Ill. 2011), <https://law.justia.com/cases/federal/district-courts/illinois/ilndce/1:2003cv03644/135030/219>.<https://casetext.com/case/people-v-gutierrez-566>
8. Supreme Court for Maryland, *Michael Pacheco v. State of Maryland*, No. 17, 2019, <https://law.justia.com/cases/maryland/court-of-appeals/2019/17-18.html>
9. Supreme Court of Colorado, *The People of the State of Colorado v. Kevin Keith Mcknight*, No. 17SC584, <https://caselaw.findlaw.com/court/co-supreme-court/1999220.html>
10. Supreme Court Of The United States, *Florida V. Jardines*, No. 11–564, 569 U.S. 1 (2013), <https://supreme.justia.com/cases/federal/us/569/1>
11. Supreme Court Of The United States, *Illinois V. Caballes*, 543 U.S. 405 (2005) No. 03–923, <https://supreme.justia.com/cases/federal/us/543/405/>
12. Supreme Court Of The United States, *United States v. Jones*, 565 U.S. 400 (2012), No. 10-1259, <https://supreme.justia.com/cases/federal/us/565/400/>
13. Supreme Court State Of North Dakota 2014 Nd 211, *State of North Dakota v. Matthew D. Nguyen*, No. 20140183, <https://law.justia.com/cases/north-dakota/supreme-court/2014/20140183.html>
14. U.S. District Court for the Northern District of Mississippi, *United States v. Marlar*, 828 F. Supp. 415, N.D. Miss. 1993 August 9, <https://law.justia.com/cases/federal/district-courts/FSupp/828/415/2352244/>
15. U.S. Supreme Court, *California v. Ciraolo*, 476 U.S. 207 (1986), No. 84-1513, <https://supreme.justia.com/cases/federal/us/476/207/>
16. U.S. Supreme Court, *Florida v. Harris*, 568 U.S. 237 (2013), No. 11-817, <https://supreme.justia.com/cases/federal/us/568/237>
17. U.S. Supreme Court, *Florida v. Jardines*, 569 U.S. 1 (2013), No. 11-564, <https://supreme.justia.com/cases/federal/us/569/1>
18. U.S. Supreme Court, *Florida v. Riley*, 488 U.S. 445 (1989), No. 87-764, <https://supreme.justia.com/cases/federal/us/488/445>
19. U.S. Supreme Court, *Katz v. United States*, 389 U.S. 347 (1967), No. 35, <https://supreme.justia.com/cases/federal/us/389/347>
20. U.S. Supreme Court, *United States v. Ibarra*, 502 U.S. 1 (1991), No. 90-1713, <https://supreme.justia.com/cases/federal/us/502/1>
21. United States Court of Appeals for the District of Columbia Circuit, *United States v. Jones*, 565 U.S. 400 (2012), No. 10-1259, <https://supreme.justia.com/cases/federal/us/565/400>
22. United States Court of Appeals, District of Columbia Circuit, *U.S. v. Colyer*, 878 F.2d 469 (D.C. Cir. 1989), <https://casetext.com/case/us-v-colyer>
23. United States Court of Appeals, Eighth Circuit, *United States of America v. Kevin Anthony Roby*, No. 97-1051, <https://caselaw.findlaw.com/court/us-8th-circuit/1004707.html>
24. United States Court of Appeals, Eighth Circuit, *United States Of America v. Democrus Pernell Burston*, No. 14–3213, <https://caselaw.findlaw.com/court/us-8th-circuit/1719311.html>

25. United States Court of Appeals, Eighth Circuit, *United States v. Hopkins*, 824 F.3d 726 (8th Cir. 2016), <https://casetext.com/case/united-states-v-hopkins-124>
26. United States Court of Appeals, Fifth Circuit, *Horton v. Goose Creek Independent School Dist*, 677 F.2d 471 (5th Cir. 1982), <https://casetext.com/case/horton-v-goose-creek-independent-school-dist>.
27. United States Court of Appeals, Fifth Circuit, *Horton v. Goose Creek Independent School Dist*, 677 F.2d 471 (5th Cir. 1982), <https://casetext.com/case/horton-v-goose-creek-independent-school-dist>.
28. United States Court of Appeals, Fifth Circuit, *United States of America v. Darrin Antonio Soza*, No. 16-41689, <https://caselaw.findlaw.com/court/us-5th-circuit/1878610.html>
29. United States Court of Appeals, Fifth Circuit, *United States Of America v. James Patrick Kelly*, No. 01-40467, <https://caselaw.findlaw.com/court/us-5th-circuit/1156105.html>
30. United States Court of Appeals, First Circuit, *United States of America, Appellee, v. Edison Burgos–Montes*, No. 13–2305, <https://caselaw.findlaw.com/court/us-1st-circuit/1700881.html>
31. United States Court of Appeals, Ninth Circuit, *U.S. v. \$215,300 U.S. Currency*, 882 F.2d 417 (9th Cir. 1989), No. 87-5826, <https://casetext.com/case/us-v-215300-us-currency>
32. United States Court of Appeals, Ninth Circuit, *U.S. v. U.S. Currency \$83,310.78*, 851 F.2d 1231 (9th Cir. 1988), No. 87-1853, <https://casetext.com/case/us-v-us-currency-8331078>
33. United States Court of Appeals, Ninth Circuit, *U.S. v. U.S. Currency*, 39 F.3d 1039 (9th Cir. 1994), No. 92-55919, <https://casetext.com/case/us-v-us-currency-3006000>
34. United States Court of Appeals, Second Circuit, *United States of America v. Ramon REYES*, No. 03-1119, <https://caselaw.findlaw.com/court/us-2nd-circuit/1423190.html>
35. United States Court of Appeals, Seventh Circuit, *Doe v. Renfrow*, 631 F.2d 91 (7th Cir. 1980), <https://casetext.com/case/doe-v-renfrow-2>
36. United States Court of Appeals, Seventh Circuit, *United States of America v. Lonnie Whitaker*, Nos. 14–3290, 14–3506, <https://caselaw.findlaw.com/court/us-7th-circuit/1731606.html>
37. United States Court of Appeals, Sixth Circuit, *United States of America v. David W. Sharp*, , No. 10–6127, <https://caselaw.findlaw.com/court/us-6th-circuit/1607477.html>
38. United States Court of Appeals, Tenth Circuit, *United States of America v. Juan Antonio Vazquez*, No. 08-4044., <https://caselaw.findlaw.com/court/us-10th-circuit/1025922.html>
39. United States District Court Northern District Of California, *People v. Herring*, No. B249468 (Cal. Ct. App. Apr. 22, 2015), <https://casetext.com/case/people-v-herring-104>
40. United States District Court, D. Kansas, *U.S. v. Culpepper*, No. 03-40086-01-SAC (D. Kan. Oct. 14, 2003), <https://casetext.com/case/us-v-culpepper-4>
41. United States District Court, D. Massachusetts, *United States v. Bain*, 155 F. Supp. 3d 107 (D. Mass. 2015), No. 14-10115, <https://casetext.com/case/united-states-v-bain-8>