UNIVERSITÀ DEGLI STUDI DI VERONA

Il naso dei cani funziona meglio del laboratorio

Giuseppe Lippi (Verona)

Canis lupus familiaris

Il cane (*Canis lupus familiaris* Linnaeus, 1758) è un mammifero appartenente all'ordine Carnivora, della famiglia dei canidi.

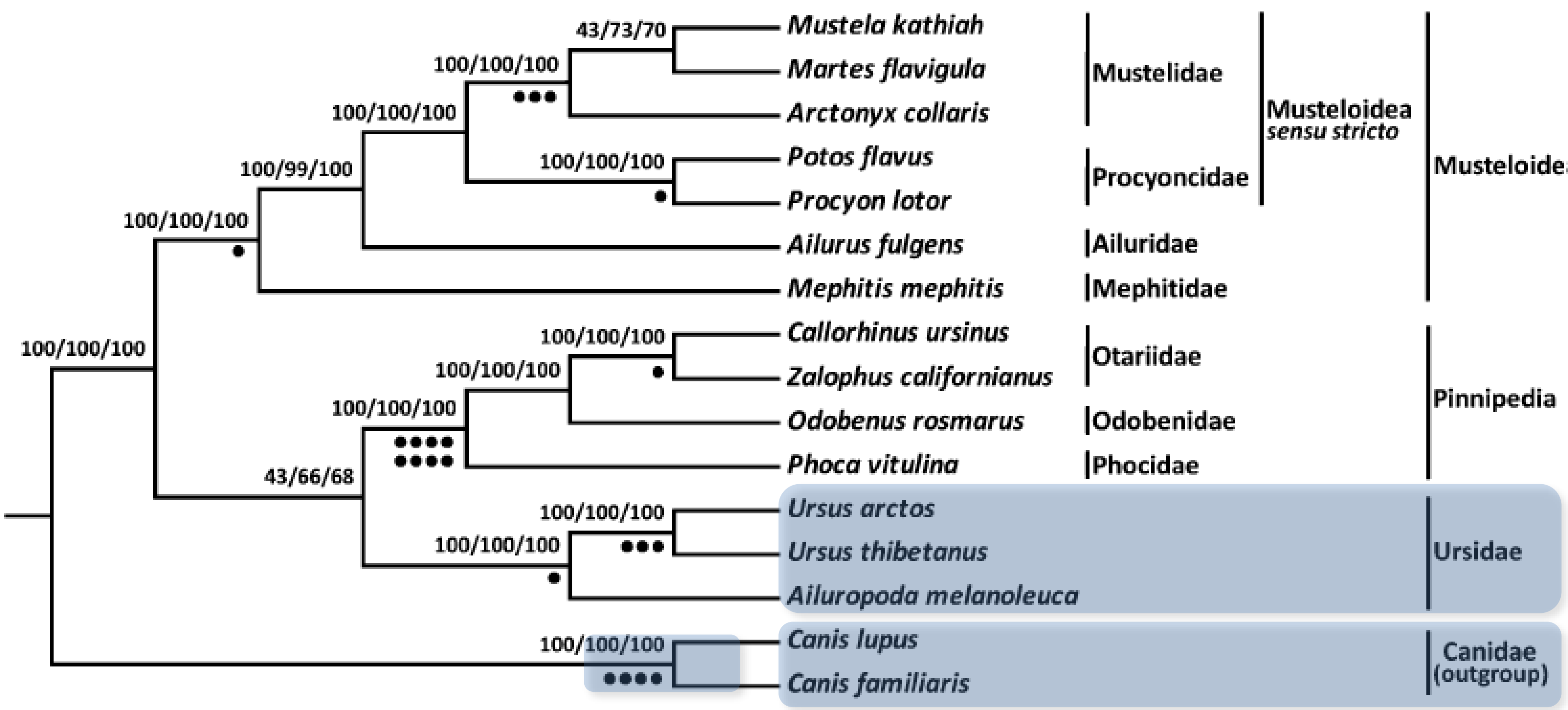
Con l'avvento dell'addomesticamento si è distinto dal lupo.

UNIVERSITÀ DEGLI STUDI DI VERONA

Syst. Biol. 60(2):175–187, 2011

Phylogenetic Utility of Nuclear Introns in Interfamilial Relationships of Caniformia (Order Carnivora)

LI YU[1,2,*,†], PENG-TAO LUAN[1,2,†], WEI JIN[1,2], OLIVER A. RYDER[3], LEONA G. CHEMNICK[3], HEIDI A. DAVIS[3], AND YA-PING ZHANG[2,*]



Syst. Biol. 60(2):175–187, 2011

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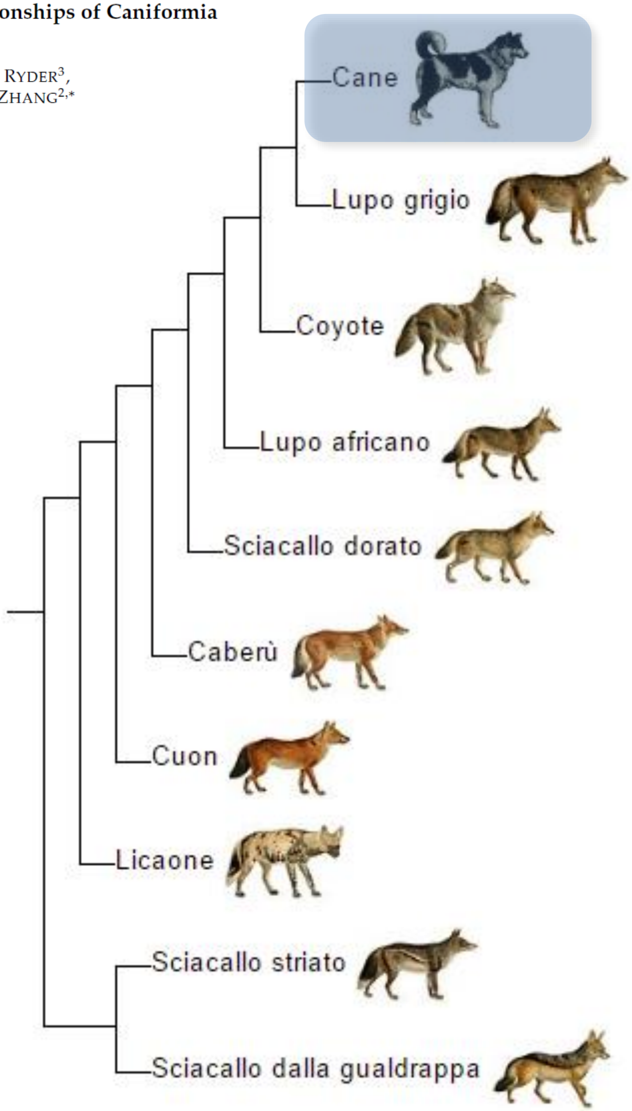

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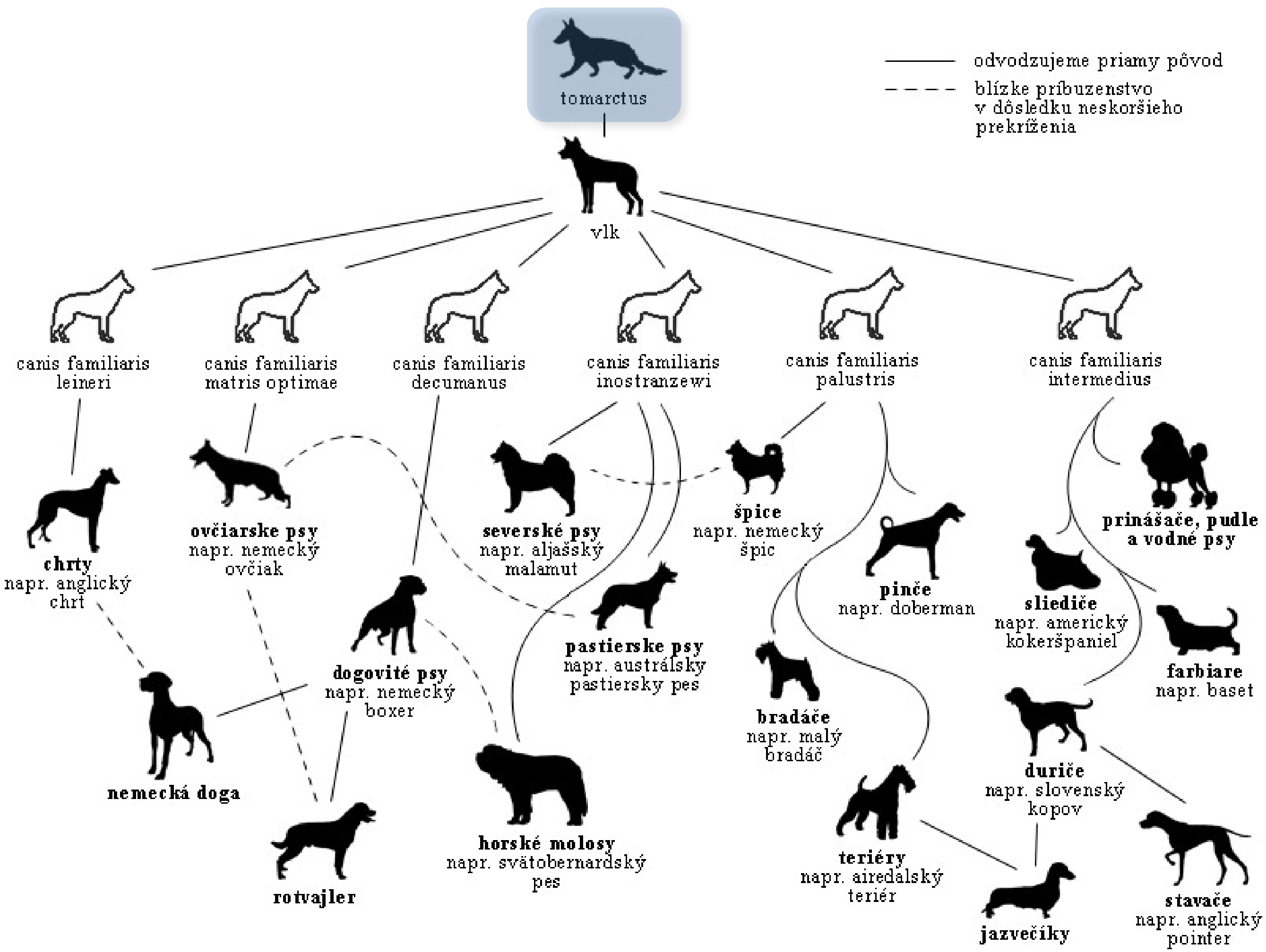
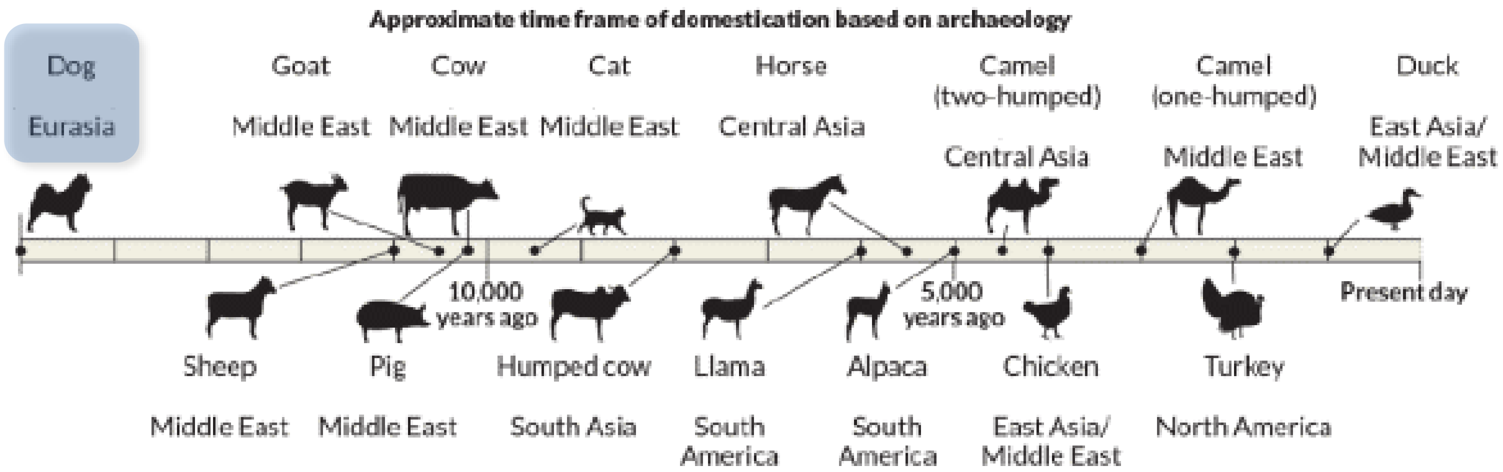
Syst. Biol. 60(2):175–187, 2011

Phylogenetic Utility of Nuclear Introns in Interfamilial Relationships of Caniformia (Order Carnivora)

Li Yu[1,2,*,†], Peng-Tao Luan[1,2,†], Wei Jin[1,2], Oliver A. Ryder[3], Leona G. Chemnick[3], Heidi A. Davis[3], and Ya-ping Zhang[2,*]





L'addomesticazione del cane da parte dell'uomo ha origini antichissime. I più antichi resti fossili di cane in uno stanziamento umano sono stati rinvenuti in una tomba natufiana, e risalgono a 11,000-12,000 anni fa.
Si suppone però che l'origine del rapporto fra le due specie si collochi più indietro nel tempo, fra 20,000 e 36,000 anni fa

Cosa accadde realmente …

Ho tanto freddo, tanta fame …
Laggiù c'è un accampamento di umani attorno ad un fuoco …
Cosa potrà mai accadermi di male se mi avvicino?

Circa 30000 anni dopo!

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Physiol. Res. 65: 369-390, 2016

Olfactory Sensitivity in Mammalian Species

M. WACKERMANNOVÁ[1], L. PINC[2], †L. JEBAVÝ[3]

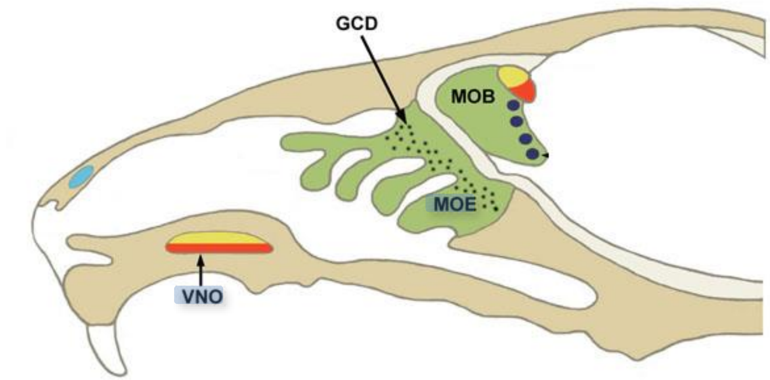
1. Olfaction mediates the perception of volatile chemicals.

2. Variations in the precise structure of individual odorant molecules, concentrations of those molecules, and specific combinations of components in a mixture of odorant molecules provide crucial information about the surrounding world.

Physiol. Res. 65: 369-390, 2016

Olfactory Sensitivity in Mammalian Species

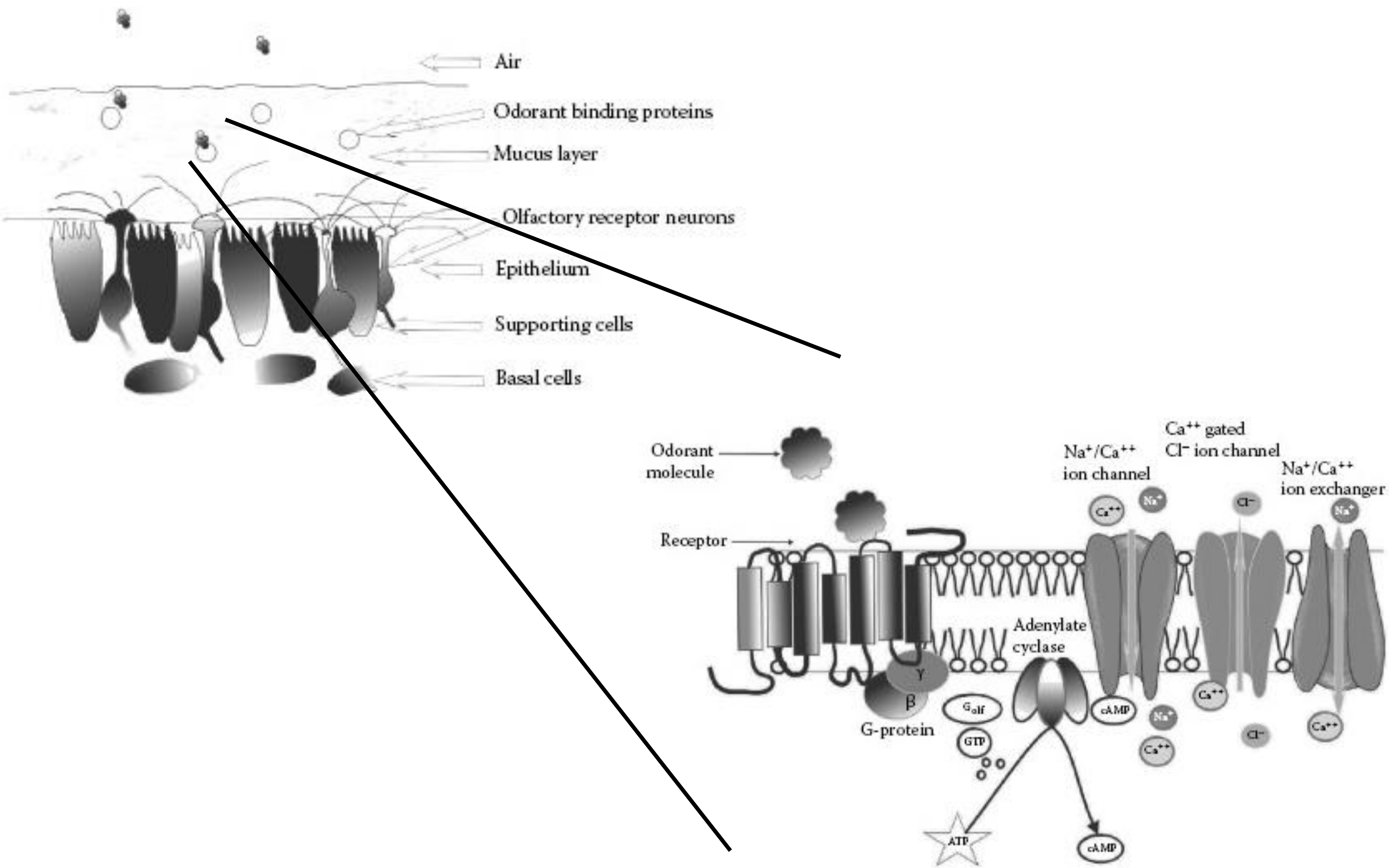
M. WACKERMANNOVÁ[1], L. PINC[2], †L. JEBAVÝ[3]



The **nose**, the main olfactory organ, consists of multiple olfactory subsystems:

1. **Main olfactory epithelium (MOE)**, composed of two types of cells:
   - microvillar cells
   - olfactory sensory neurons (OSNs)

2. **Vomeronasal organ (VNO)**, containinig:
   - two olfactory subsystems (apical and basal)
   - two classes of vomeronasal receptors (V1Rs and V2Rs)


Air
Odorant binding proteins
Mucus layer
Olfactory receptor neurons
Epithelium
Supporting cells
Basal cells
Odorant molecule
Receptor
Na^+/Ca^{++} ion channel
Ca^{++} gated Cl^- ion channel
Na^+/Ca^{++} ion exchanger
Adenylate cyclase
γ
β
G-protein
G_{olf}
GTP
ATP
cAMP

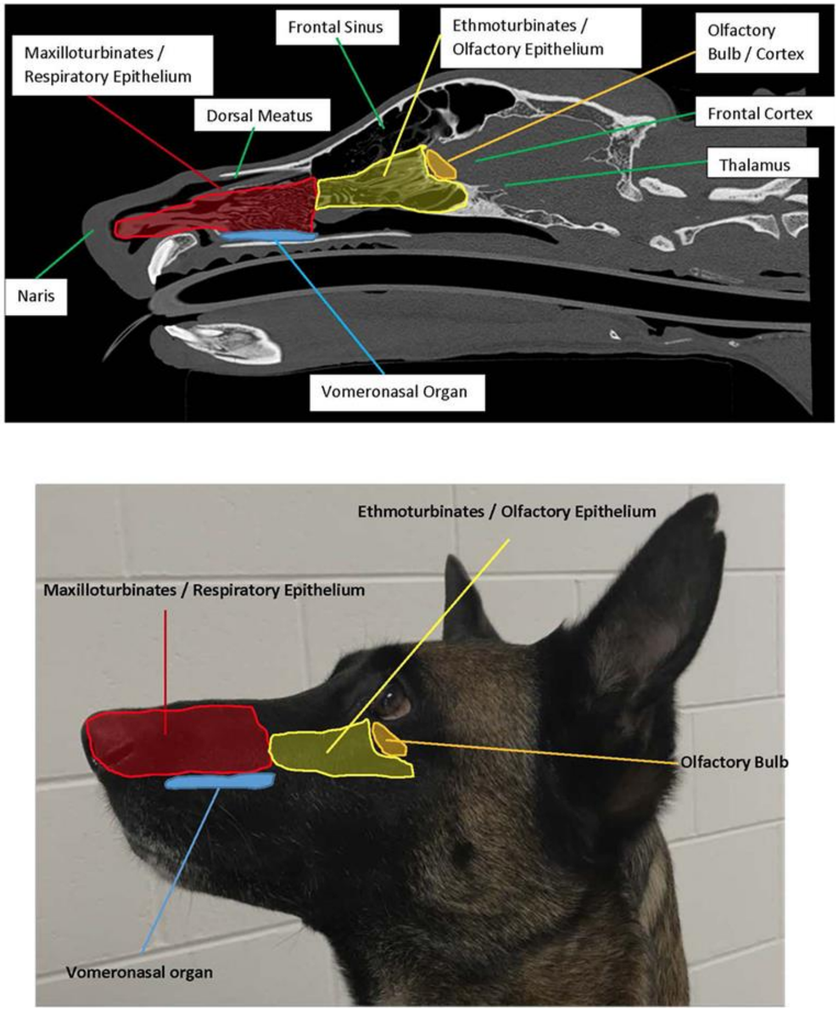
Clin Ter 2016; 167 (4):e78-84.

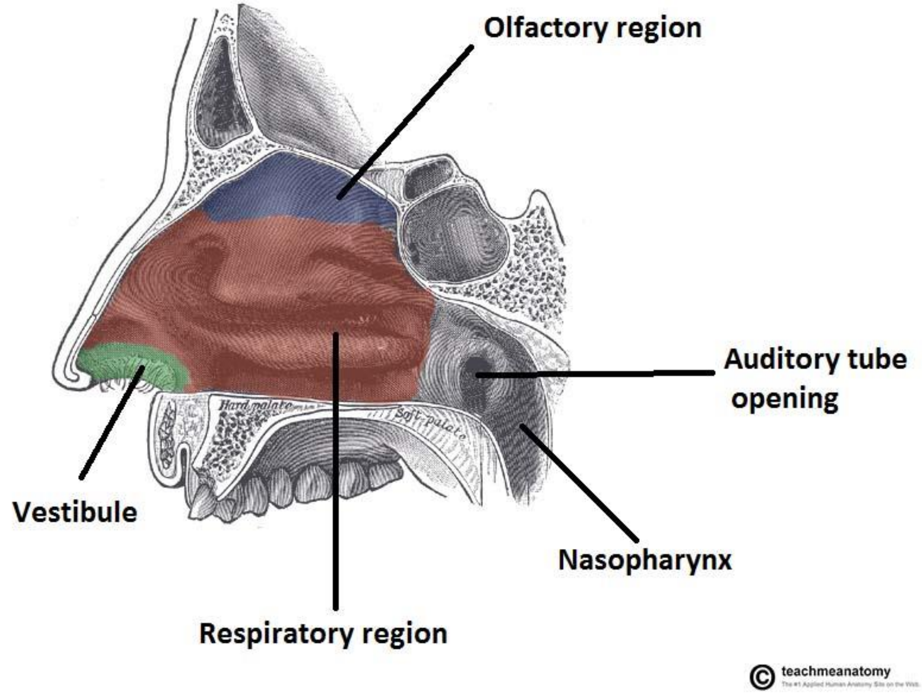
La diagnostica olfattiva del cane applicata alla specie umana: stato dell'arte e prospettive cliniche

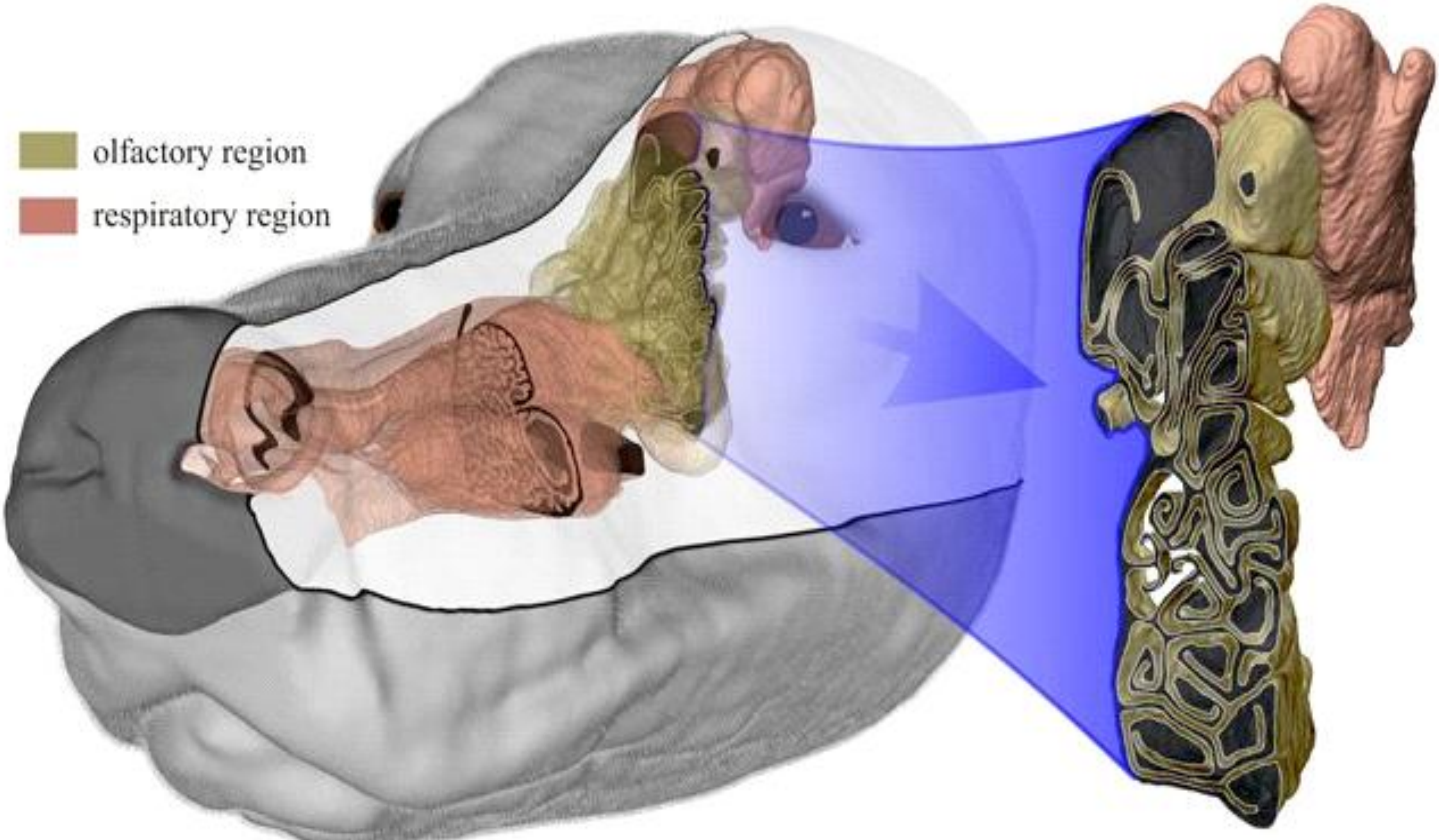
B. Palmieri[1,2], B. Nardo[3], G. Lippi[4], L. Palmieri[1], M. Vadalà[1,2], C. Laurino[1,2]

Le capacità olfattive dei cani sono di fatto circa 10.000 – 100.000 più sviluppate rispetto all'uomo.

A
B


Frontal Sinus
Ethmoturbinates / Olfactory Epithelium
Olfactory Bulb / Cortex
Maxilloturbinates / Respiratory Epithelium
Dorsal Meatus
Frontal Cortex
Thalamus
Naris
Vomeronasal Organ
Ethmoturbinates / Olfactory Epithelium
Maxilloturbinates / Respiratory Epithelium
Olfactory Bulb
Vomeronasal organ

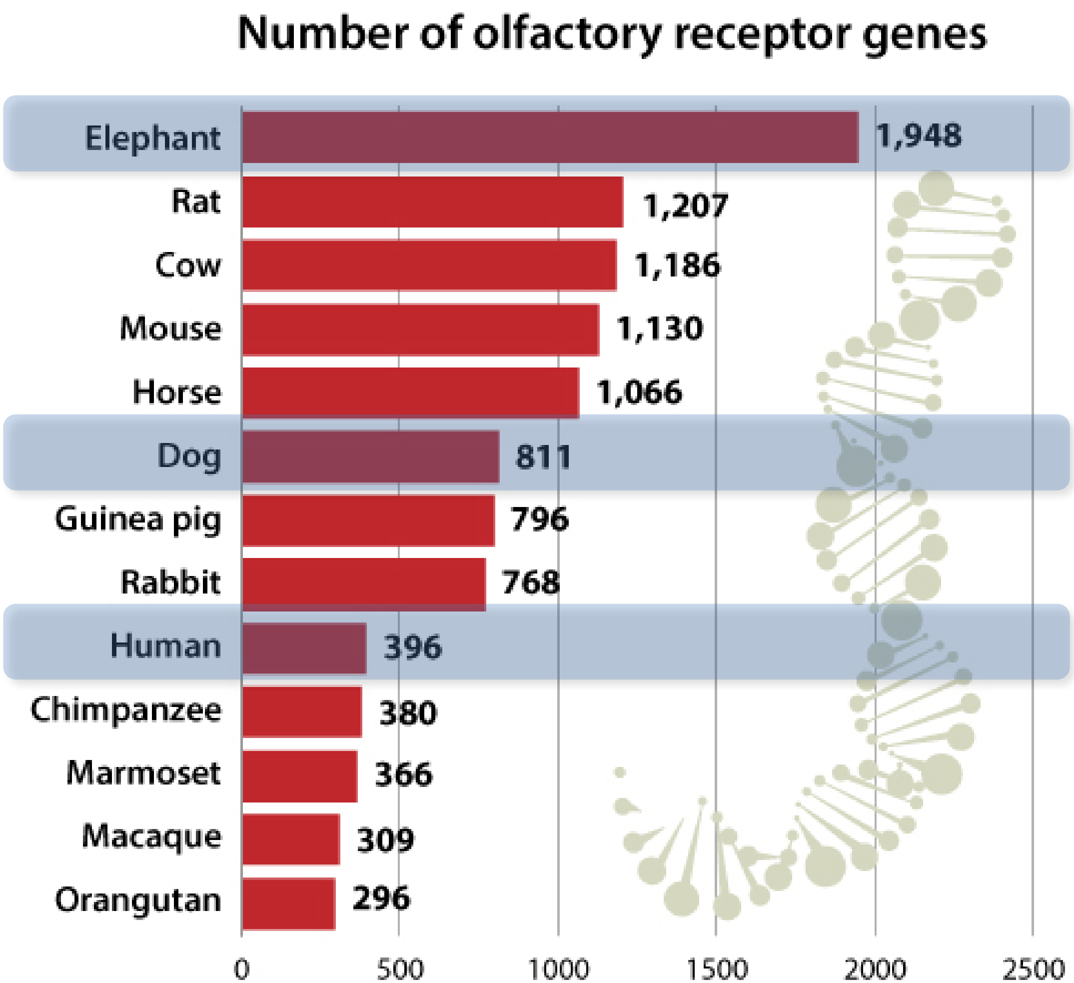

Olfactory region
Auditory tube opening
Vestibule
Nasopharynx
Respiratory region
Hard palate
Soft palate
teachmeanatomy


olfactory region
respiratory region

Genome Research 24:1485–1496

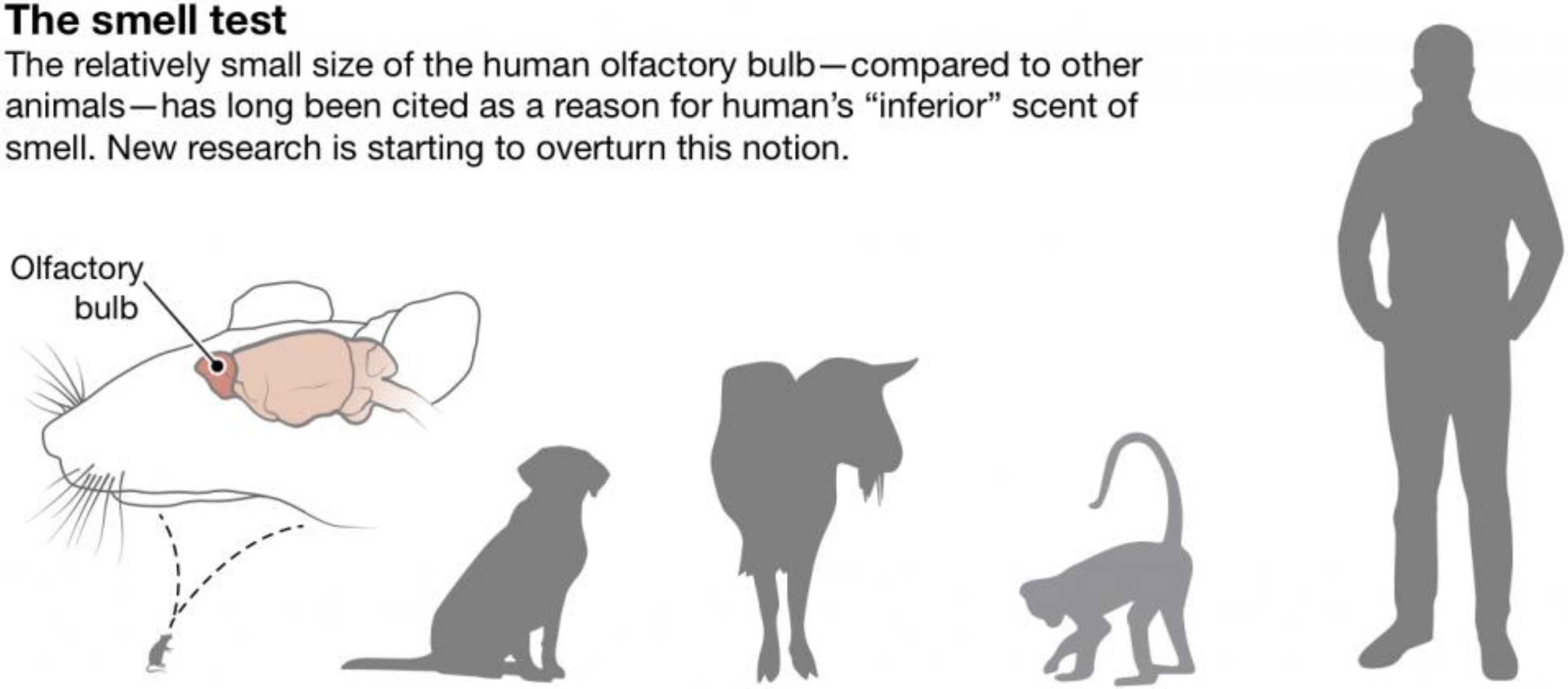
Extreme expansion of the olfactory receptor gene repertoire in African elephants and evolutionary dynamics of orthologous gene groups in 13 placental mammals

Yoshihito Niimura,[1,2] Atsushi Matsui,[1,2] and Kazushige Touhara[1,2]



The smell test

The relatively small size of the human olfactory bulb—compared to other animals—has long been cited as a reason for human's "inferior" scent of smell. New research is starting to overturn this notion.



Mouse	Dog	Goat	Macaque	Human
2%	**0.31%**	**0.18%**	**0.1%**	**0.01%**

Percent of olfactory bulb to total brain volume

Credits: (Graphic) C. Bickel/*Science*; (Data) McGann *et al.*, *Science* **356** (12 May 2017)/Kavoi and Jameela, *Int. J. Morphol.* **29 (3)**: 939–946, 2011/Seidlitz *et al.*, *NeuroImage* (28 April 2017)

Clin Ter 2016; 167 (4):e78-84.

La diagnostica olfattiva del cane applicata alla specie umana: stato dell'arte e prospettive cliniche

B. Palmieri[1,2], B. Nardo[3], G. Lippi[4], L. Palmieri[1], M. Vadalà[1,2], C. Laurino[1,2]

Parametro	Uomo	Cane
Dimensione bulbo olfattivo	~1 cm	~3 cm
Estensione dell'epitelio olfattivo	3-4 cm^2	18-150 cm^2
Numero di recettori olfattivi	5-6 Milioni	150-300 Milioni
Geni che codificano per i recettori	350	1100

The Indian Journal of Veterinary Science Vol. 2(1) Feb'14

Olfactory Sense in Different Animals

Padodara, R. J.[1*] and Ninan Jacob[2]

Species	Number of Scent Receptors
Humans	5 million
Dachshund	125 million
Fox Terrier	147 million
Beagle	225 million
German Shepherd	225 million
Bloodhound	300 million

Physiol. Res. 65: 369-390, 2016

Olfactory Sensitivity in Mammalian Species

M. WACKERMANNOVÁ[1], L. PINC[2], †L. JEBAVÝ[3]

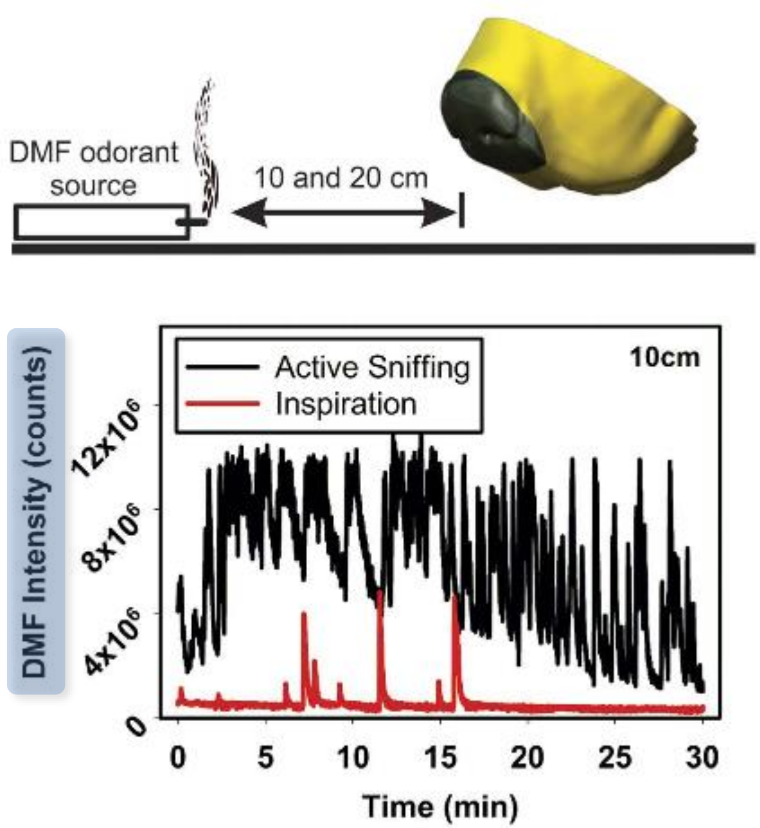
Table 1. Olfactory detection thresholds for laboratory chemical substances in vapor phase in ppm concentration.

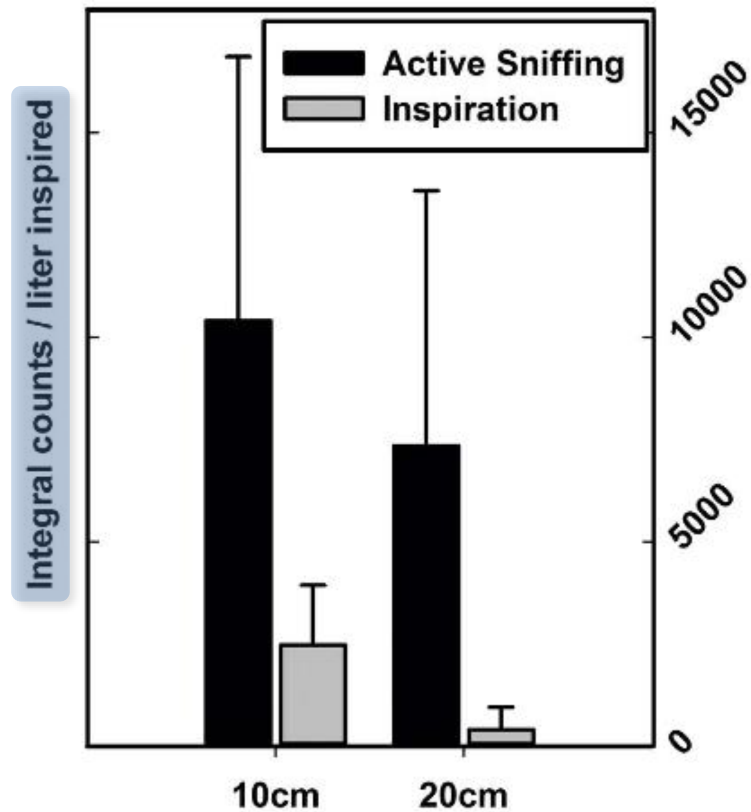
Chemical class	Chemical substance	Human	Pigtail macaque	Spider monkey	Squirrel monkey	Dog	Mouse
Aliphatic alcohols	pentanol	x	0.29	0.0004	0.0004	x	0.00003
	hexanol	x	0.006	0.006	0.006	x	0.0003
	heptanol	x	0.0032	0.0003	0.00031	x	
	octanol	0.00064	0.0048	0.0048	0.048	x	
	propanal	0.002	x	x	x	x	
Aliphatic aldehydes	butanal	x	0.0004	0.039	0.0039	0.00004	
	pentanal	x	0.148	0.00148	0.0148	x	
	heptanal	x	0.0024	0.00235	0.00235	0.00004	
	hexanal	0.00014	0.00052	0.0052	0.052	x	
	ocatanal	0.0014	0.0016	0.00016	0.16	x	
	burgeonal	x	x	x	x	0.000000001	x
Acetate esters	amyl acetate	0.00011	0.14	x	x	0.0000114	
	ethyl acetate	0.245	x	0.036	x	x	0.0000041
	butyl acetate	0.0043	x	0.00006	x	x	
	pentyl acetate	x	x	0.000027	x	x	
	hexyl acetate	0.0029	x	0.00013	x	x	
Carboxylic acids	butanoic acid	x	x	x	x	x	0.000003
	pentanoic acid	x	x	x	x	x	0.000003
Amid acids	panthotenic acid	x	0.0019	x	x	x	x
Nitroalkanes	dimethyl dinitrobut.	x	x	x	x	0.0005	x
Thiols	ethanethiol	x	0.000096	0.00000096		x	x
	butanethiol	x	0.000016	0.00016	0.00016	x	x
	pentanethiol	x	0.00063	0.00063	0.00063	x	x
Thiazolines	trimethylthiazoline	x	x	x		x	40.00
Indols	indole	x	0.00000003	0.0003	0.00000003	x	x
	methyl indole	x	0.000037	0.0000037	0.000012	x	x
Ketones	nonanone	0.0055	x	x	x	x	x
Sulfides	hydrogen sulfide	2.00	x	x	x	x	x
Amino acids	cystein	x	x	0.0013	x	0.0000044	x
	methionine	x	x	0.0011	x	0.000036	x
	proline	x	x	0.002	x	0.023	x
Alkylpyrazines	pyrazine	x	x	27.80	x	0.028	x
	methyl pyrazine	x	x	0.044	x	0.0001	x
	tetramethyl pyr.	x	x	0.00063	x	0.00000092	x
Benzenes	butylbenzene	0.00025	x	x	x	x	x
	octylbenzene	0.00029	x	x	x	x	x
	propylthietane	0.0000000059	x	x	x	x	x
Sulfur-containing volatiles	methylbutyl form.	0.0000000013	x	x	x	x	x
	propylthiethane		x	0.0000074	x	0.00003	x
	butanethiol	0.00000052	x	0.0000026	x	0.00000003	x
	phenylethyl sulfide	0.0000016	x	0.0000012	x	0.00000003	x

SCIENTIFIC REPORTS | 6:36876 | DOI: 10.1038/srep36876

Biomimetic Sniffing Improves the Detection Performance of a 3D Printed Nose of a Dog and a Commercial Trace Vapor Detector

Matthew E. Staymates[1], William A. MacCrehan[1], Jessica L. Staymates[1], Roderick R. Kunz[2], Thomas Mendum[2], Ta-Hsuan Ong[2], Geoffrey Geurtsen[2], Greg J. Gillen[1] & Brent A. Craven[3]





PLOS ONE | DOI:10.1371/journal.pone.0146963 February 10, 2016

Rigorous Training of Dogs Leads to High Accuracy in Human Scent Matching-To-Sample Performance

Sophie Marchal[1], Olivier Bregeras[1], Didier Puaux[1], Rémi Gervais[2], Barbara Ferry[2]*

Table 1. Proportion of correct detections (sensitivity scores: number of Hits / [Hits + Misses]) and False Alarms (specificity scores: number of CR / [CR + FA]) throughout the 10 periods of continuous training.

Periods	Scores of sensitivity ± S.E.M. (Hit / Hit + Miss) × 100	Scores of specificity ± S.E.M. (CR / CR + FA) × 100
1st	70.41 ± 2.56	100
2nd	73.46 ± 2.68	98.43 ± 1.22
3rd	75.50 ± 2.79	99.12 ± 0.88
4th	76.73 ± 2.92	100
5th	80.14 ± 3.72	99.00 ± 1.00
6th	82.62 ± 3.14	99.23 ± 0.77
7th	82.41 ± 4.19	100
8th	84.93 ± 2.69	100
9th	83.80 ± 4.99	100
10th	84.76 ± 3.83	100

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PLOS ONE | DOI:10.1371/journal.pone.0154087 May 6, 2016

A Test of Canine Olfactory Capacity: Comparing Various Dog Breeds and Wolves in a Natural Detection Task

Zita Polgár[1]*, Mari Kinnunen[1,2], Dóra Újváry[3], Ádám Miklósi[1,4], Márta Gácsi[4]

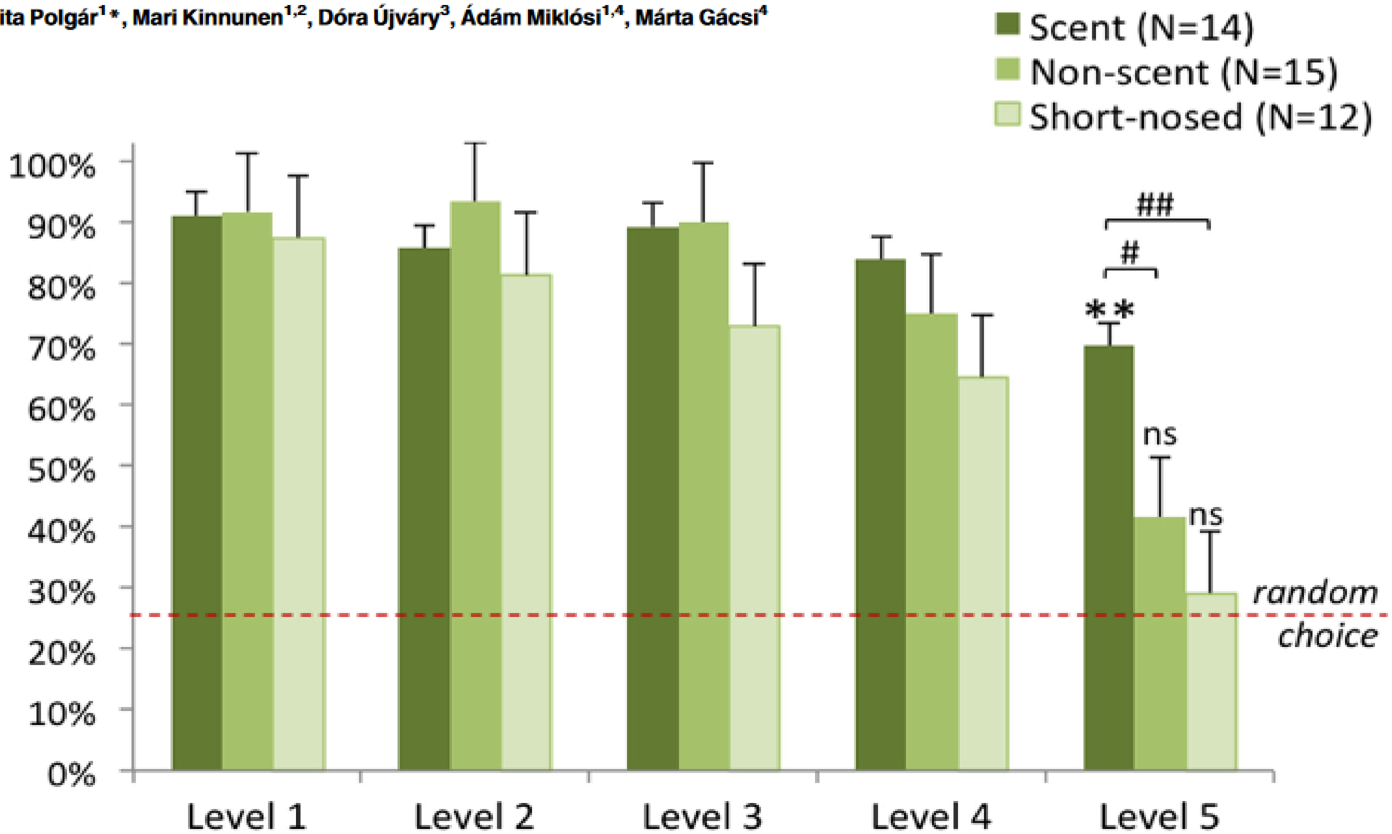


Fig 3. Performance of dogs in the Natural Detection Task. Mean (SE) performances for the three dog groups across the five levels are shown. Dashed line represents chance level; Level 5 difference from chance: ** P<0.01. Level 5 difference between groups: # P = 0.053; ## P<0.01.

TOP TEN

1. Bloodhound
2. Beagle
3. German Shepherd
4. Dachshund
5. Harrier
6. Redbone Coonhound
7. Bluetick Coonhound
8. English Foxhound
9. Labrador Retriever
10. Golden Retriever

Gut 2011;**60**:1768.

Electronic nose versus canine nose: clash of the titans

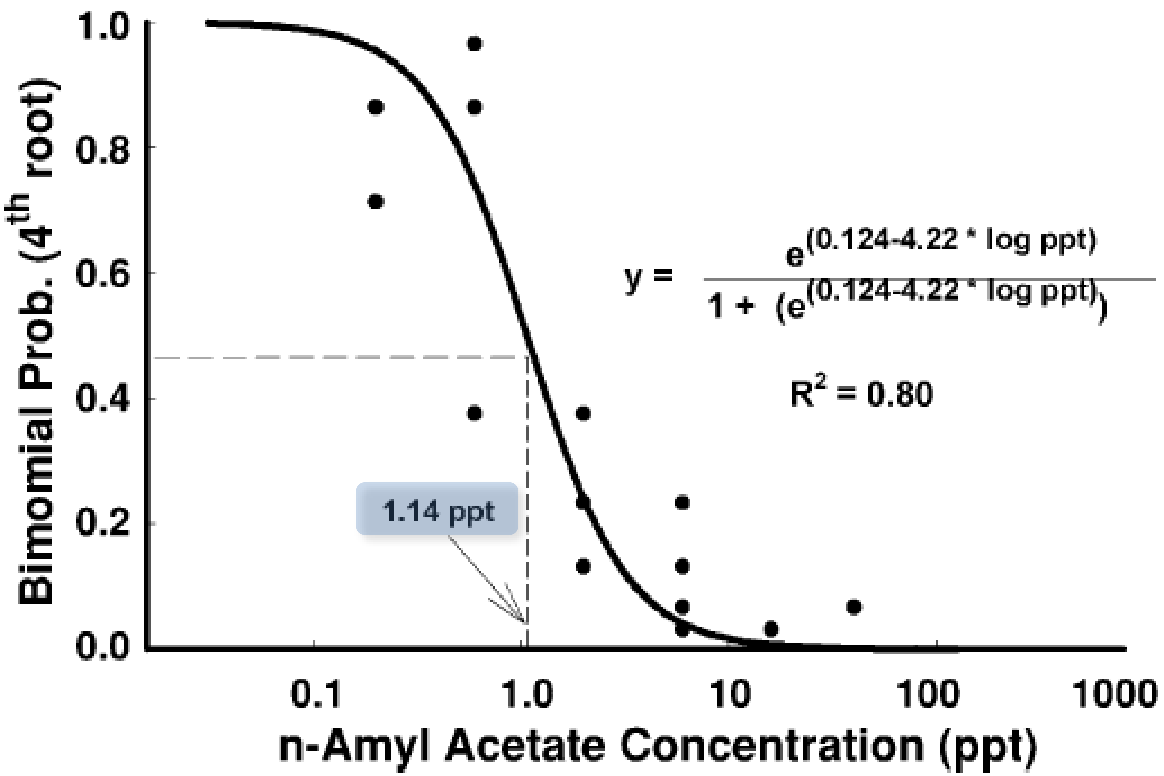
R P Arasaradnam,[1] C U Nwokolo,[1] K D Bardhan,[2] J A Covington[3]

UNIVERSITÀ DEGLI STUDI DI VERONA

Applied Animal Behaviour Science 97 (2006) 241–254

Naturalistic quantification of canine olfactory sensitivity

Dianne Beidler Walker [a], James Cornelius Walker [a,*], Peter James Cavnar [a], Jennifer Leigh Taylor [a], Duane Howard Pickel [b], Sandra Biddle Hall [c], Joseph Carlos Suarez [a]



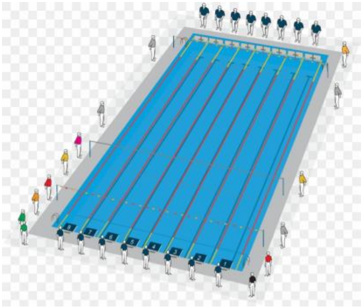
Frontiers in Veterinary Science June 2016 | Volume 3 | Article 47

Canine Detection of the Volatilome: A Review of Implications for Pathogen and Disease Detection

Craig Angle[1], Lowell Paul Waggoner[1], Arny Ferrando[2], Pamela Haney[1] and Thomas Passler[3]*

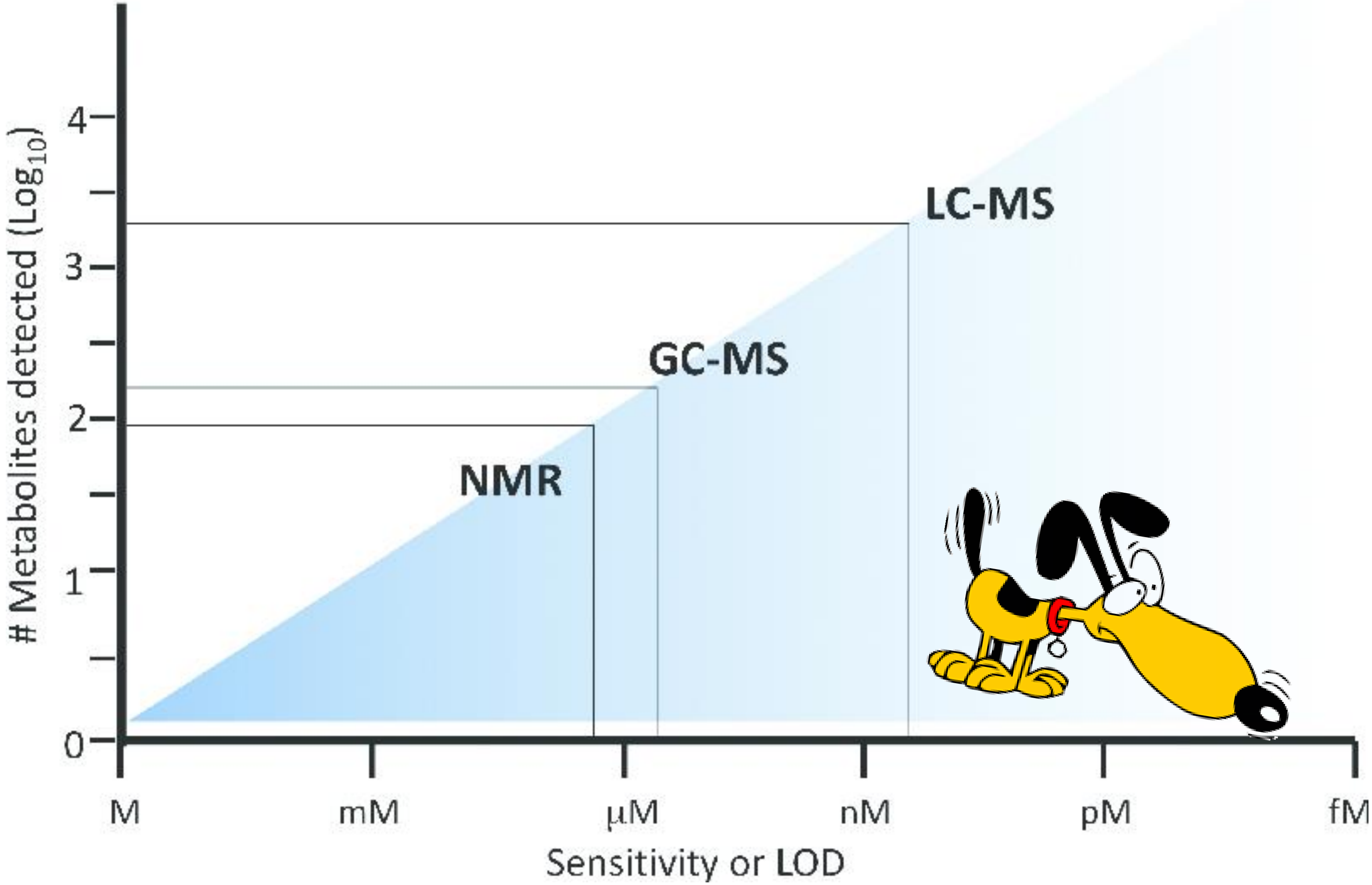
To illustrate the tremendous canine olfactory sensitivity, a dog could detect the equivalent of

1 drop of liquid in 20 Olympic-size (2500 ft^3) swimming pools



x 20

Amyl Acetate (MW) = 130.19 Da
LoD = 1.14 ppt = 0.00000000000114 g/L = 8.76 fmol/L

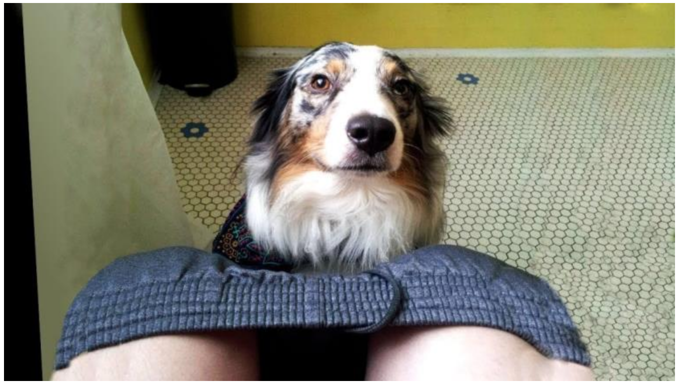


WIKIPEDIA
The Free Encyclopedia

Dogs are often called "humans' best friend" because they fit in with human life. Dogs can help humans in many ways; they can be:

- Simple pets
- Guard dogs
- Hunting dogs
- Herding dogs
- Guide dogs (e.g., for blind people)
- Police dogs
- **Sniffer (detection) dogs**

Sniffer (detection) dogs



A (sniffer) detection dog is trained to use its senses to detect many substances, such as:

- Foods
- Lost humans
- Explosives
- Illegal drugs
- Wildlife scat
- Currency
- Contraband electronics (e.g., illicit mobile phones)

…

- **Human diseases**

Sniffer (detection) dogs

Sniffer (detection) dogs

Sniffer (detection) dogs

Sniffer (detection) dogs

Sniffer (detection) dogs

The Guardian

Diseases that dogs can detect

Dogs have something called “neophilia”, which means they are attracted to new and interesting odors. The diseases they have been capable to detect so far are:

- Cancers
- Diabetes
- Seizures
- Parkinson’s disease
- Narcolepsy
- Migraine
- …


Clinical studies on
sniffer dogs

Sniffer dogs in East Yorkshire hospitals bowel cancer trial

Dr Claire Guest, CEO of Hull and East Yorkshire Hospitals NHS Trust said that "*If this trial is positive, the potential is there for a quick, non-invasive test for detecting colorectal cancer by smelling urine samples, which could encourage far higher rates of testing and therefore early diagnosis*"

Eur Urol 2011;59:197-201

Olfactory Detection of Prostate Cancer by Dogs Sniffing Urine: A Step Forward in Early Diagnosis.

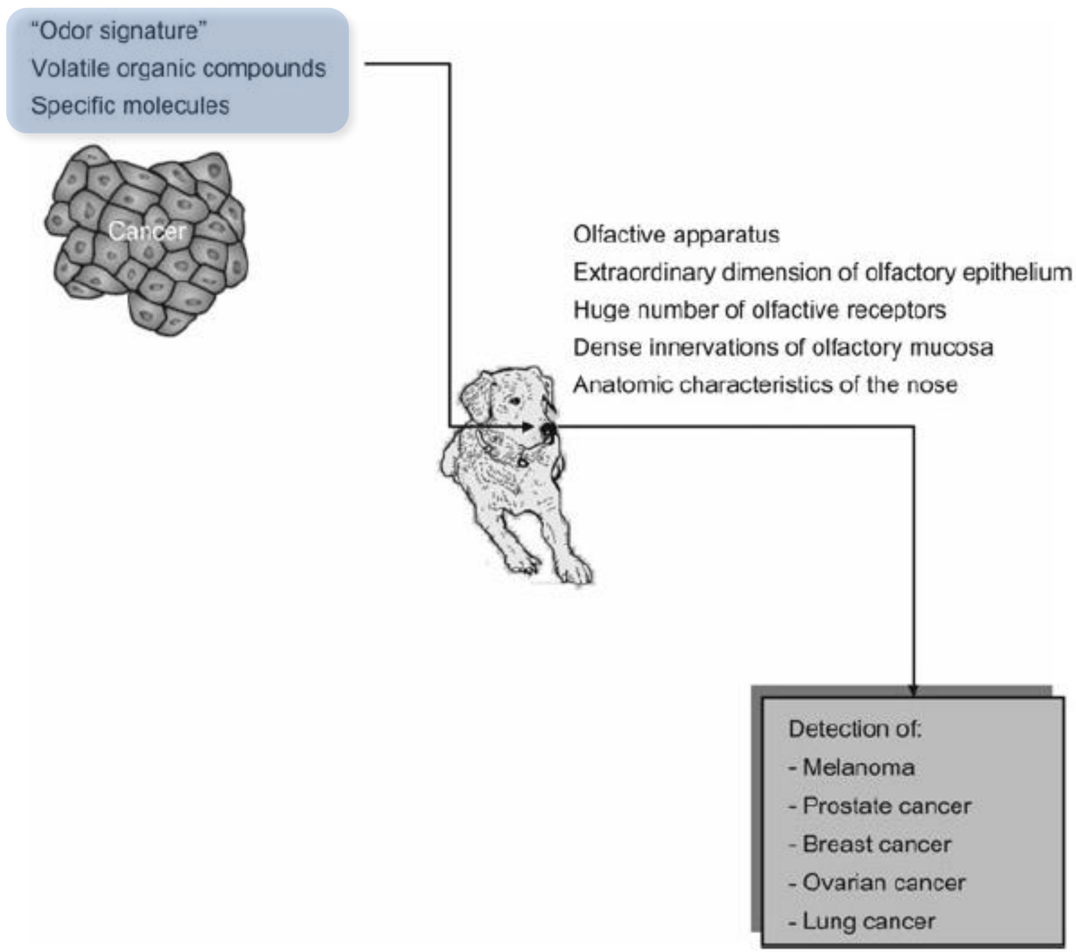
Giuseppe Lippi*

Dogs can be trained to detect prostate cancer with 91% sensitivity and specificity by smelling urine, thus surpassing the diagnostic performance of most prostate cancer biomarkers currently available

Clin Chem Lab Med 2012;50(3):435–439

Canine olfactory detection of cancer versus laboratory testing: myth or opportunity?

Giuseppe Lippi[1,*] and Gianfranco Cervellin[2]



J. Breath Res. **9** (2015) 027001

Study of the art: canine olfaction used for cancer detection on the basis of breath odour. Perspectives and limitations

Tadeusz Jezierski [1], Marta Walczak[1], Tomasz Ligor[2], Joanna Rudnicka[2] and Bogusław Buszewski[2]

Authors	Cancer type	Odour samples	Detection sensitivity %	Detection specificity %
McCulloch *et al* [21]	Lung	Breath	99	99
	Breast	Breath	88	98
Sonoda *et al* [24]	Colorectal	Breath	91	99
	Colorectal	Feces	97	99
Ehmann *et al* [26]	Lung	Breath	71	93
Walczak *et al* [37]	Lung	Breath	83.4–83.6[a]	77.9–80.5[a]
			53.6–54.0[a]	b
	Breast	Breath	89.2–90.5[a]	83.9–88.8[a]
			66.8–67.8[a]	b
	Melanoma	Breath	66.3–80.2[a]	77.2–87.4[a]
			32.2–58.6[a]	b
Amundsen *et al* [29]	Lung	Breath	56–64	8–33
	Lung	Urine	64–74	25–29

SCIENTIFIC REPORTS | (2018) 8:2732

Evaluation of Serum CEA, CA19-9, CA72-4, CA125 and Ferritin as Diagnostic Markers and Factors of Clinical Parameters for Colorectal Cancer

Yanfeng Gao[1], Jinping Wang[2], Yue Zhou[3], Sen Sheng[4], Steven Y. Qian[5] & Xiongwei Huo[6]

	Markers	Sensitivity	Specificity
Single Marker	CEA	46.59% (130/279)	80% (59/74)
	CA199	14.39% (41/279)	89% (66/74)
	CA724	44.80% (125/279)	97% (72/74)
	CA125	10.04% (28/279)	99% (73/74)
	SF	10.39% (29/279)	95% (70/74)

	Markers	Sensitivity	Specificity
Four to Five Markers Combination	CEA + CA199 + CA724 + CA125	66.67% (186/279)	76% (56/74)
	CEA + CA199 + CA724 + SF	65.59% (183/279)	73% (54/74)
	CEA + CA199 + CA125 + SF	56.63% (158/279)	76% (56/74)
	CEA + CA724 + CA125 + SF	66.31% (185/279)	73% (54/74)
	CA199 + CA724 + CA15 + SF	60.22% (168/279)	82% (61/74)
	CEA + CA199 + CA724 + CA125 + SF	67.38% (188/279)	73% (54/74)

J. Breath Res. **9** (2015) 027001

Study of the art: canine olfaction used for cancer detection on the basis of breath odour. Perspectives and limitations

Tadeusz Jezierski [1], Marta Walczak[1], Tomasz Ligor[2], Joanna Rudnicka[2] and Bogusław Buszewski[2]

Correlation coefficients between selected compounds and the dogs' indications

Volatile compound	Pearson's correlation coefficient with dogs' indications
% Indications	
2-Pentanone	0.97
Ethyl acetate	0.85
Hexane	0.50
Pentane	0.47
Toluene	0.30
2-Methylpropane	0.29
Ethanol	0.27
Butane	0.26
2-Methylpentane	0.14
Benzene	0.11
Isoprene	0.07
2-Butanone	– 0.51
2-Propanol	– 0.60
Carbon disulfide	– 0.67
Acetone	– 0.77
Acetonitrile	– 0.78
Propanal	– 0.87
1-Propanol	– 0.98

Clin Ter 2016; 167 (4):e78-84.

La diagnostica olfattiva del cane applicata alla specie umana: stato dell'arte e prospettive cliniche

B. Palmieri[1,2], B. Nardo[3], G. Lippi[4], L. Palmieri[1], M. Vadalà[1,2], C. Laurino[1,2]

Neoplasia	Descrizione dello studio
Melanoma e carcinoma polmonare (in vitro)	Due pastori belgi furono educati dapprima a percepire cellule neoplastiche della mammella in coltura, e successivamente ulteriori ceppi tumorali. La sensibilità discriminativa di questi animali raggiungeva nell'esperimento livelli di sensibilità diagnostica pari al 100%.
Carcinoma baso-cellulare	Caso aneddotico di un Labrador che ha riconosciuto un carcinoma baso-cellulare del suo padrone
Carcinoma della mammella e del polmone	5 cani sono stati educati per 3-5 settimane a distinguere l'odore del respiro di pazienti neoplastici, convogliando vapore all'interno di cilindri utilizzati per lo studio. Nel gruppo di pazienti con cancro del polmone la sensibilità diagnostica raggiunse il 99%, mentre fu lievemente inferiore per il cancro della mammella (88%).
Neoplasie dell'intestino retto e dell'ovaio	Composti organici volatili sono stati caratterizzati analiticamente in campioni biologici e poi riconosciuti dai cani con sensibilità, specificità ed accuratezza significativa.
Neoplasie dell'ovaio in fase di remissione dopo chemioterapia	Sono stati confrontati campioni di plasma ottenuti da donne con cancro ovarico in fase di remissione dopo chemioterapia con il plasma di 210 campioni di donne di controllo. Due animali allenati furono in grado di identificare la presenza di tumore con sensibilità del 97% ed specificità del 99%. Questa capacità fu confermata anche nei medesimi pazienti a distanza di 3 e 6 mesi.
Neoplasie della prostata	E' stata valutata la capacità di un cane addestrato per 24 mesi nel discernere composti organici volatili, dopo aver annusato campioni di urine di 33 pazienti affetti da tumore maligno prostatico e di 33 pazienti sani di controllo. I risultati hanno evidenziato una sensibilità ed una specificità per l'identificazione del tumore pari al 91%.
Neoplasie della vescica	Sensibilità del 73% e specificità del 64% nell'identificare il cancro della vescica da parte di un gruppo di cani addestrati a fiutare le urine, rispetto ad una specificità tra il 92% ed il 56% nel fiutare le urine di soggetti sani giovani ed anziani.

Clin Chem Lab Med 2019; 57(4): 452–458

Giuseppe Lippi* and Mario Plebani

Diabetes alert dogs: a narrative critical overview

Acknowledgments: This article is dedicated to Armstrong (Figure 1) and to all the other dogs engaged in saving human lives.

Figure 1: Armstrong, *Guinness Book of World Records* entrant for being capable of warning his owner of the risk of a hypoglycemic episode.

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PLOS ONE August 2013 | Volume 8 | Issue 8 | e69921

Investigation into the Value of Trained Glycaemia Alert Dogs to Clients with Type I Diabetes

Nicola J. Rooney[1]*, Steve Morant[2], Claire Guest[3]

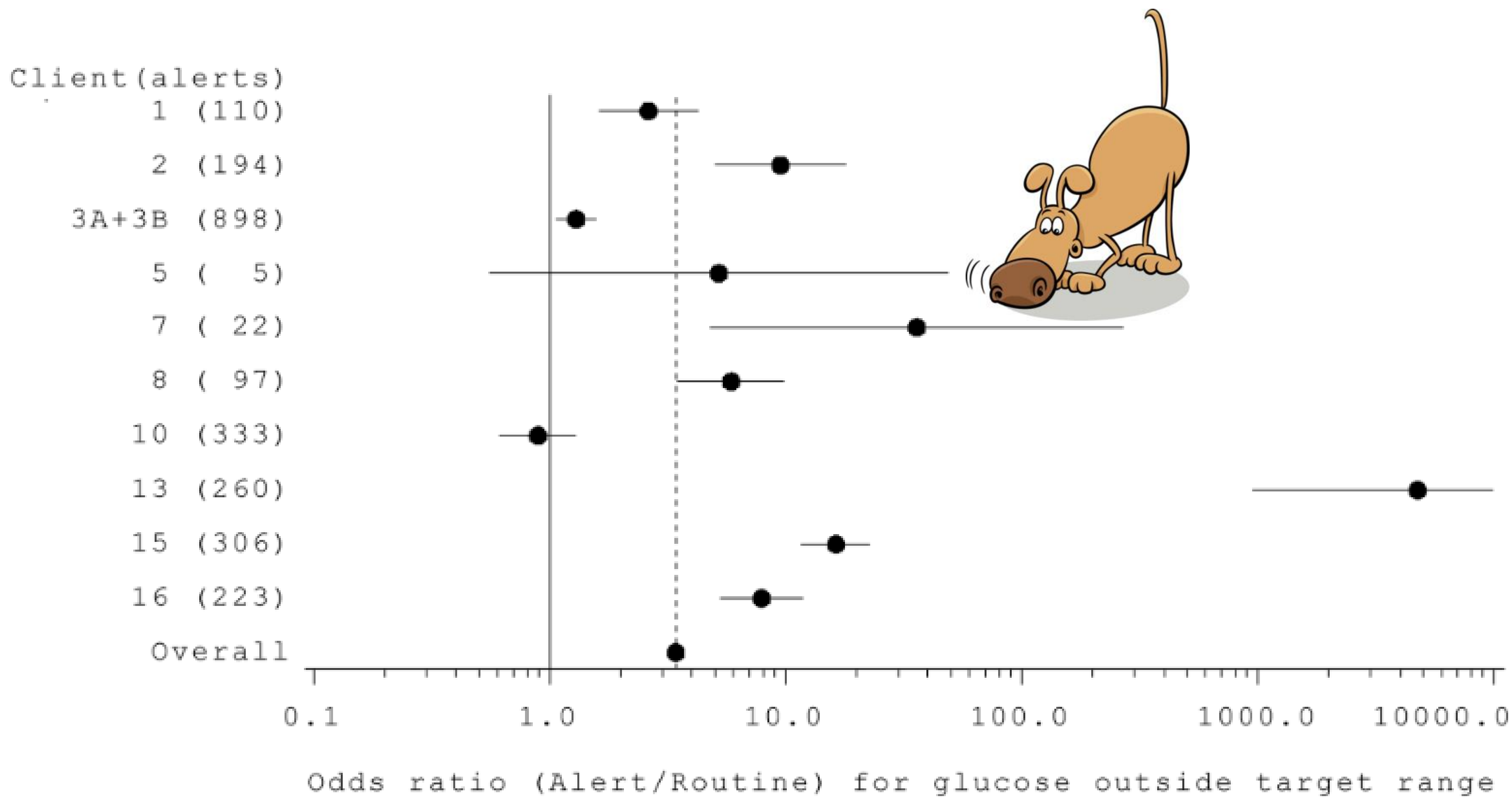

Figure 1. Odds ratios (Alert/Routine) for samples with glucose concentrations outside each client's target range in alert samples

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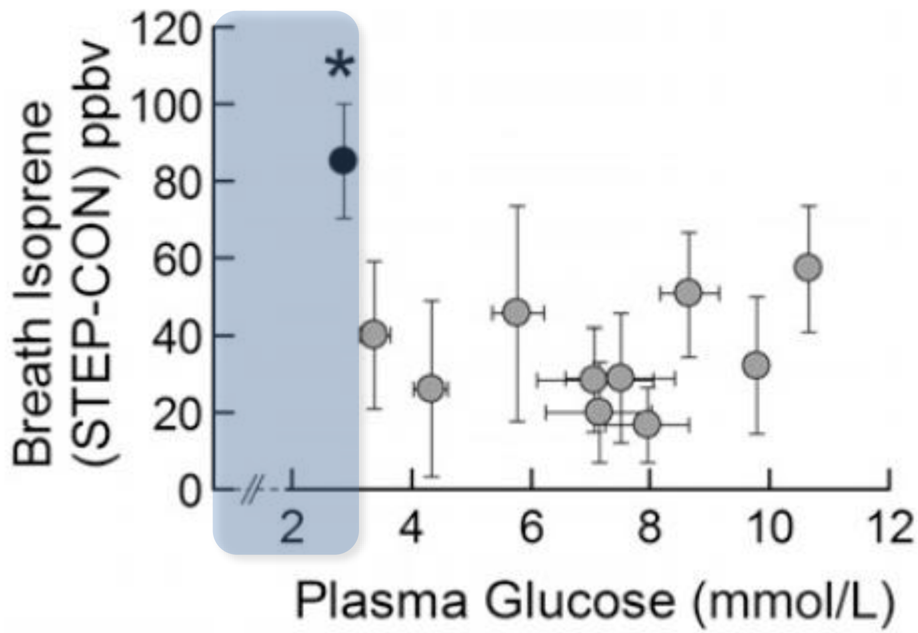
Table 1: Summary of human studies analyzing dog's efficiency for alerting the owner on episodes of hypoglycemia or hyperglycemia.

Study	Sample size	Observation period	Outcome	Performance
Rooney et al., 2013 [9]	17 Subjects (1 type and 16 type 2 diabetes)	≥1 Month	Detecting hyperglycemia	0.80 Sensitivity
Dehlinger et al., 2013 [10]	3 Dogs each challenged with 24 Human cotton swabs (12 collected during hypoglycemia)	–	Detecting hypoglycemia	Accuracy, 0.55 (0.56 sensitivity and 0.54 specificity)
Hardin et al., 2015 [11]	6 Dogs each challenged with 7 Human perspiration samples (1 collected during hypoglycemia)	–	Detecting hypoglycemia	Accuracy, 0.93 (0.78 sensitivity and 0.96 specificity)
Los et al., 2017 [12]	8 Type 1 diabetics	3 Months	Detecting hypoglycemia	Sensitivity, 0.36
Gonder-Frederick et al., 2017 [13]	14 Subjects (7 with type 1 and 7 With type 2 diabetes)	Median, 29 Days	Detecting both hypo- and hyperglycemia	Cumulative accuracy, 0.48 (0.29 sensitivity and 0.66 specificity)
Gonder-Frederick et al., 2017 [14]	18 Type 1 diabetics	Median, 134 Days	Detecting both hypo- and hyperglycemia	Cumulative accuracy, 0.54 (0.57 sensitivity and 0.49 specificity)

Diabetes Care 2016;39:e97–e98

Exhaled Breath Isoprene Rises During Hypoglycemia in Type 1 Diabetes

Sankalpa Neupane



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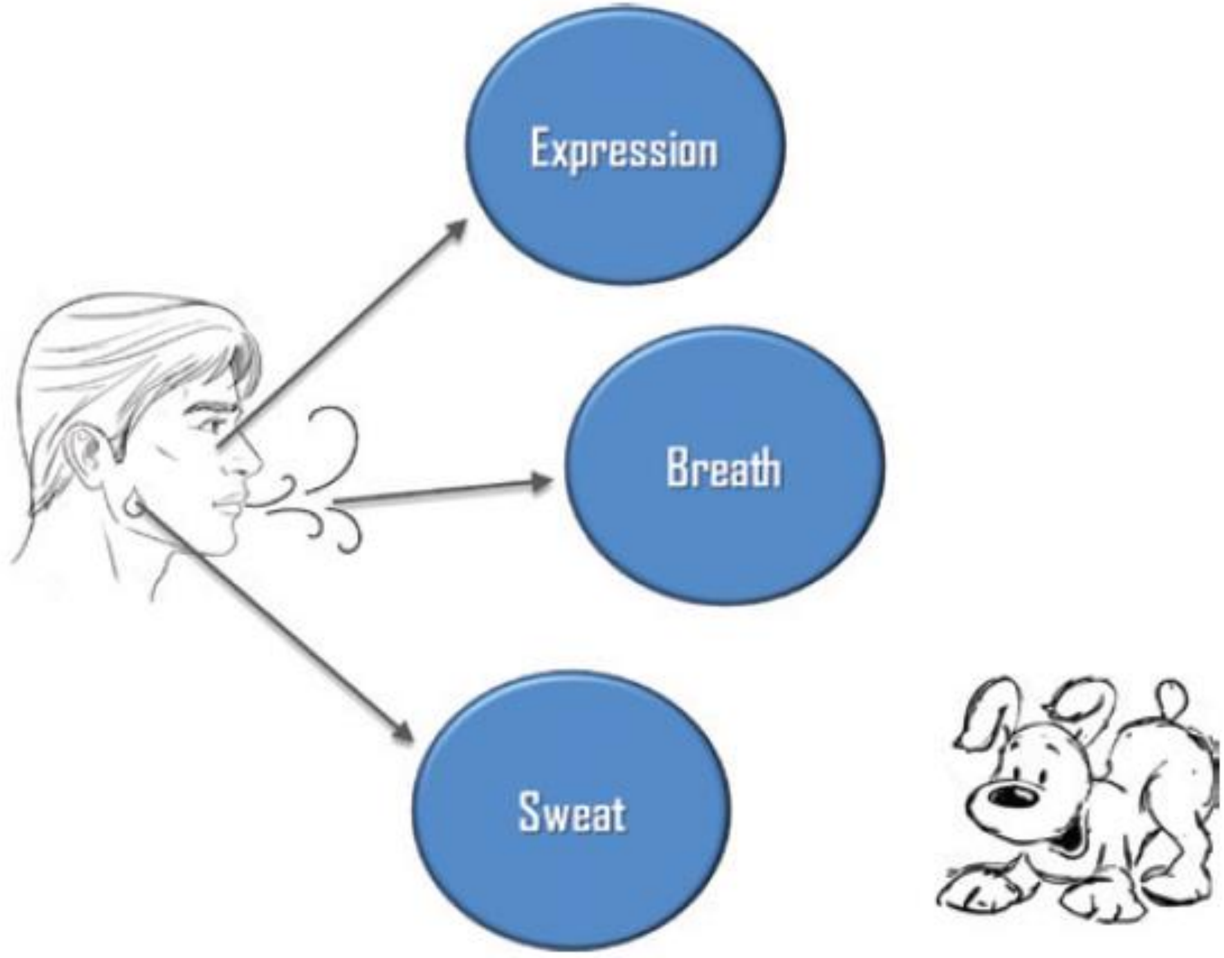

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Table 2. Extent to which each client reported agreeing with each of ten statements regarding the effect of the dog upon their lives.

	5	4	3	2	2
Number of clients reporting each category	**totally agree**	**somewhat agree**	**neither agree nor disagree**	**somewhat disagree**	**totally disagree**
I am more independent since I obtained my dog	12	2 **(88%)**	2	0	0
Having a trained dog is a big commitment	5	6	1	2	2
The dog has enhanced my quality of life	13	2 **(94%)**	1	0	0
There are disadvantages of having an alert dog	0	0	4	4	8
I enjoy the conversations which the dog's coat promotes	5	4	7	0	0
I trust my dog to alert me when my sugar levels are low	11	3 **(88%)**	1	0	1
I dislike the attention which the coat attracts	0	2	4	2	8
I am totally satisfied with my dog	13	2	1	0	0
If I had my time again, I wouldn't get a dog	0	0	0	1	15
I trust my dog to alert me when my sugars are high	6	7 **(81%)**	0	1	2

Seizure 2003; **12:** 115–120

Seizure-alert dogs: a review and preliminary study

DEBORAH J. DALZIEL[†], BASIM M. UTHMAN[†,‡], SUSAN P. MCGORRAY[§] & ROGER L. REEP[¶]

- Of the 29 subjects who owned dogs, 9 (31%) reported that their dog responded to a seizure

- These dogs remained close to their human either standing or lying alongside them, sometimes licking the person's face or hands during and immediately after the seizure

- Of the nine dogs reported to respond, 3 (10%) also alert their human to an impending seizure

SCIENTIFIC REPORTS | (2019) 9:4103

Dogs demonstrate the existence of an epileptic seizure odour in humans

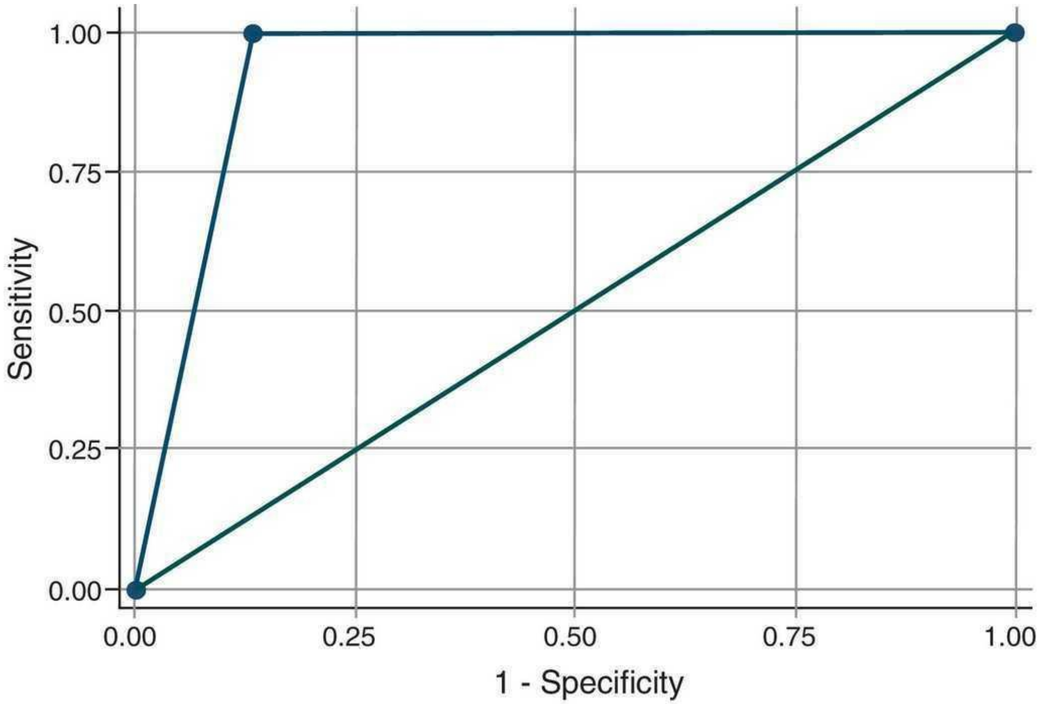
Amélie Catala[1,2], Marine Grandgeorge[1], Jean-Luc Schaff[2,3,4], Hugo Cousillas[5], Martine Hausberger[6] & Jennifer Cattet[7]

Dogs	Sensitivity (%)	Specificity (%)
Casey	100	100
Dodger	100	100
Lana	67	95
Zoey	100	100
Roo	67	95
Total	86,8	98

Sleep Medicine 14S (2013) e93–e164

Narcolepsy and odour: preliminary report

D. Dominguez-Ortega [1], E. Diaz Gallego [2], F. Pozo [3],
C. García-Armenter [4], M. Serrano-Comino [5], E. Dominguez-Sanchez [6]



Area under Roc curve = 0.9318

Obs	Roc Area	Std. Err.	- Asymptotic normal- [95% Conf. interval]	
34	0.9318	0.0374	0.85843	1.00000

Semergen. 2013;39:e41–6

UNIVERSITÀ DEGLI STUDI DI VERONA

The Journal of Alternative and Complementary Medicine, VOL. 19, NO. 6 | Original Articles

Survey of Migraine Sufferers with Dogs to Evaluate for Canine Migraine-Alerting Behaviors

Dawn A. Marcus | and Amrita Bhowmick

Interventions and outcome measures.
Participants who experience migraine episodes and live with a dog completed an online survey asking on demographics, migraines and dog's behavior before or during migraine episodes.

Results.
A recognized change in the dog's behavior prior to or during the initial phase of migraine was endorsed by 53.7% participants
Dog alerting behavior before symptoms of migraine would begin, with changes usually noticed within 2 hours before the onset of initial migraine symptoms, was identified by 57.3% participants.

What the future holds?

Clin Ter 2016; 167 (4):e78-84.

La diagnostica olfattiva del cane applicata alla specie umana: stato dell'arte e prospettive cliniche

B. Palmieri[1,2], B. Nardo[3], G. Lippi[4], L. Palmieri[1], M. Vadalà[1,2], C. Laurino[1,2]

Tabella 2. Descrizione di patologie caratterizzate dalla presenza di composti organici volatili in diverse tipologie di material potrebbero essere identificati dal fiuto dei cani, opportunamente allenati.

Patologia	Materiale biologico	Markers	Sensibilità e specificità
Steatosi e steatoepatite non alcolica	Aria espirata, urine, feci	Composti organici volatili	Specificità del 79% e sensibilità del 73%
Celiachia	Feci, urine, aria espirata	1,3,5,7 – cicloottatrene	Sensibilità del 91% e specificità dell'85%
Sindrome del colon irritabile	Feci, urine, aria espirata	Acido cicloesanocarbossilico ed i suoi esteri	Sensibilità compresa tra 90-96% e specificità compresa tra l'80-82%
Malattie infiammatorie croniche intestinali	Feci, urine, aria espirata	Aldeidi	Sensibilità compresa tra 90-96% e specificità compresa tra l'80-82%
Patologie renali	Urine, aria espirata	Acido solfidrico (H_2S)	Non disponibile
Glomerulonefrite proliferativa mesangiale (MsPGN)	Urine	Acido carbammico, sali di monoammonio, disolfuro di carbonio, silanediolo, dimetile – 2H – 1,4 –benzodiazepinaa – 2-1, 7- cloro – 1,3 – diidro – 5 – fenil – 1 – (trimetilisilil) ed idrossitoluene butilato	Non disponibilie
Nefropatie da IgA (IgAN)	Urine	2-pentanone, pirrolo e 4 – eptanone	Non disponibile
Patologie renale	Aria espirata	Acetone, 2-pentanone ed etanolo	Sensibilità del 96%

Frontiers in Veterinary Science January 2016 | Volume 2 | Article 79

Real-Time Detection of a Virus Using Detection Dogs

T. Craig Angle[1], Thomas Passler[2], Paul L. Waggoner[1], Terrence D. Fischer[1], Bart Rogers[1], Patricia K. Galik[3] and Herris S. Maxwell[2]*

	Dog 1	Dog 2
Sensitivity	0.85	0.967
Specificity	0.981	0.993
Total number of search past targets (i.e., misses)	6	1
Total number of positive indications	28	30
Total number of positive trials	34	31
Total number of blank trials (i.e., no BVDV present)	24	20
Total number of negative samples searched	317	287
Total number of false indications	6	2

PUBLIC RELEASE: 29-OCT-2018

New study reports dogs successfully diagnosed malaria by sniffing socks worn by African children

At TropMed 2018, scientists share research on ultra-sensitive canine noses detecting distinctive odor emitted by malaria parasites; potential for dogs to assist malaria elimination campaigns

AMERICAN SOCIETY OF TROPICAL MEDICINE AND HYGIENE

- For the test, trained dogs had to distinguish between socks from children with malaria parasites and socks from uninfected children.

- They were trained to sniff each sample and to freeze if they thought they detected malaria, or move on if they did not.

- The dogs correctly identified 70% of infected children and 90% of uninfected children.

In conclusione …

Cos’è che scrivono stì ignoranti? Che in lab son più bravi di noi??? Ah, ah, ah!!!

ALTERNATIVE THERAPIES, NOV/DEC 2016 VOL. 22 NO. 6

Hypoglycemia Alert Dogs: A Novel, Cost-effective Approach for Diabetes Monitoring?

Giuseppe Lippi, MD; Gianfranco Cervellin, MD; Maurizio Dondi, DVM; Giovanni Targher, MD

To date, a number of companies around the world, both not-for-profit or for-profit, are providing highly trained dogs with proven abilities.

Due to available evidence and plausible biological bases, broadening the use of these dogs for a myriad of medical purposes should be seen as reasonable.

J. Breath Res. **9** (2015) 027001

Study of the art: canine olfaction used for cancer detection on the basis of breath odour. Perspectives and limitations

Tadeusz Jezierski [1], Marta Walczak[1], Tomasz Ligor[2], Joanna Rudnicka[2] and Bogusław Buszewski[2]

The canine sense of smell outperforms current analytical devices, with dogs able to detect trace amounts of several compounds.

However the canine detection of diseases is still a “ black-box technology ” - i.e., it is not known to which volatile compounds or their combination the dogs react.

The “olfactory fingerprint” loop

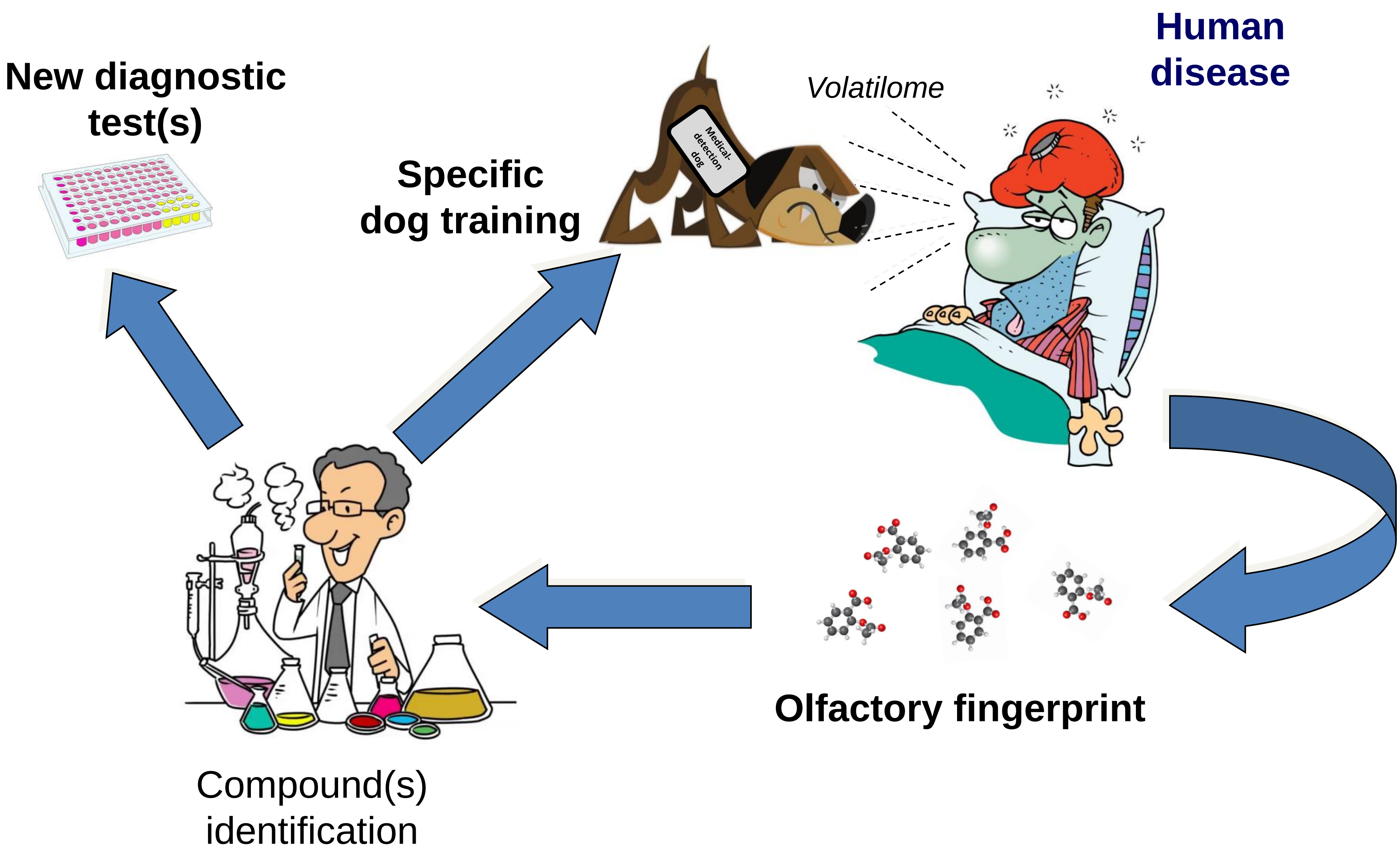


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Table 2: Current drawbacks of diabetes alert dogs.

– Cost for adopting and keeping the dog
– Certification or accreditation of dogs' providers
– Harmonization of training procedures
– Inter-breed, intra-breed and intra-dog variability
– Heterogeneity of dogs' alert behaviors
– Capability of owners to identify altered behaviors
– Quality assurance and verification
– Quality indicators


Per tutti quelli
che non amano
i cani 😝
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