Disruptive innovation with olfactory receptors

By Alain Frix, Allchemix Consultancy BV

June 19th 2025

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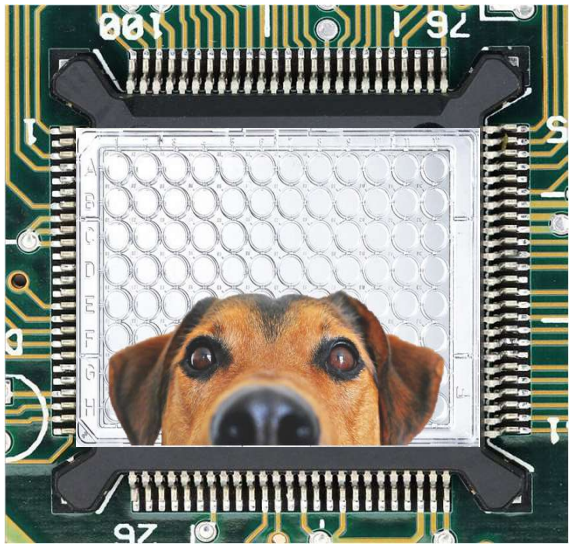
Disruptive innovation with olfactory receptors



Ongoing development of portable medical biosensor using canine olfactory receptors made by synthetic biology

Purpose :

---> Early diagnosis of various human diseases.

---> High potential for very early treatment of certain cancers, drastically increasing survival rate

---> Parkinson

---> Alert for individuals with chronic epileptic seizures

Mammals' sense of smell

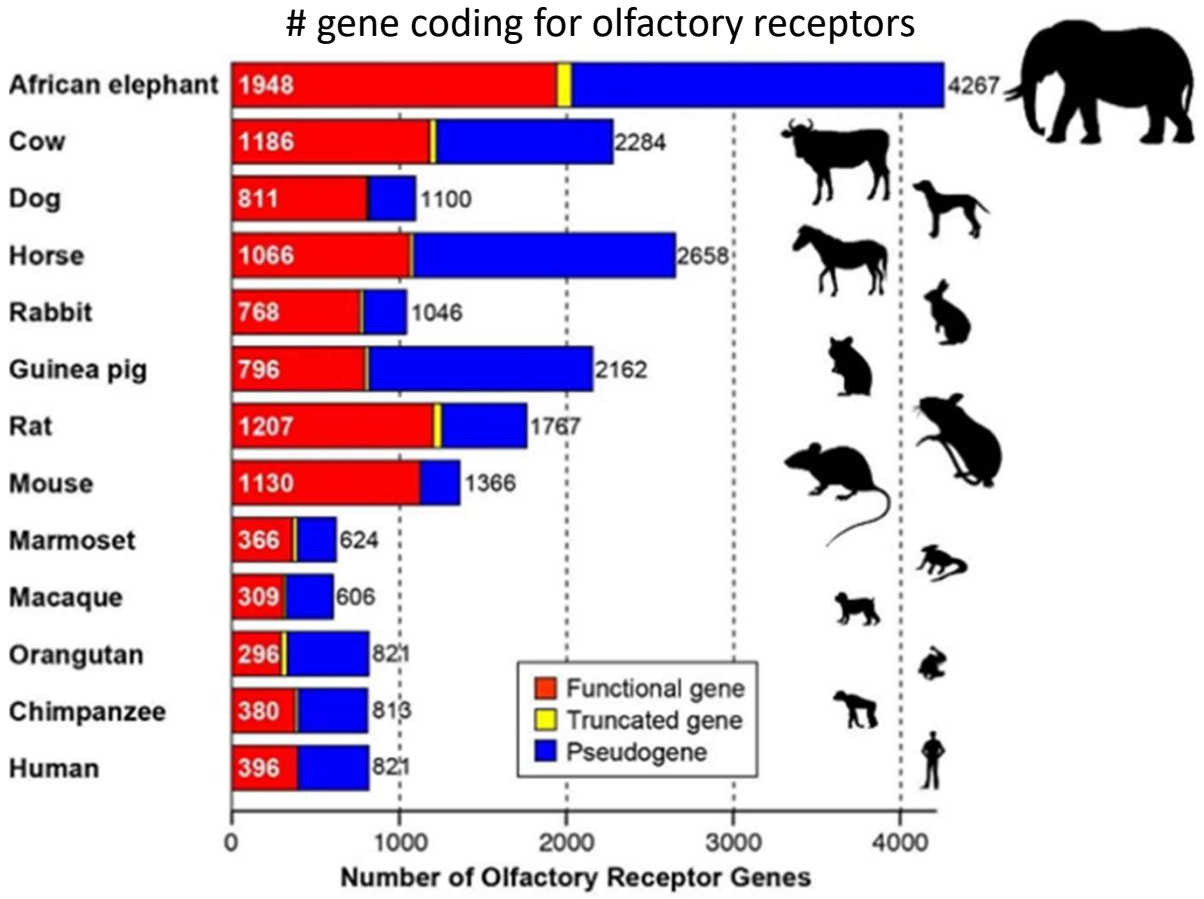
Wide variation in olfactory receptor numbers among mammals

Olfactory Receptors (OR)

Elephants
2000 genes

Dogs
800 genes
300 million OR expressed

Humans
400 genes
6 million OR expressed

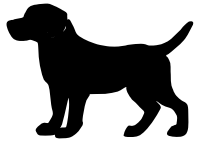


Dogs' sense of smell :

= **10,000 to 100,000 times more sensitive** than humans

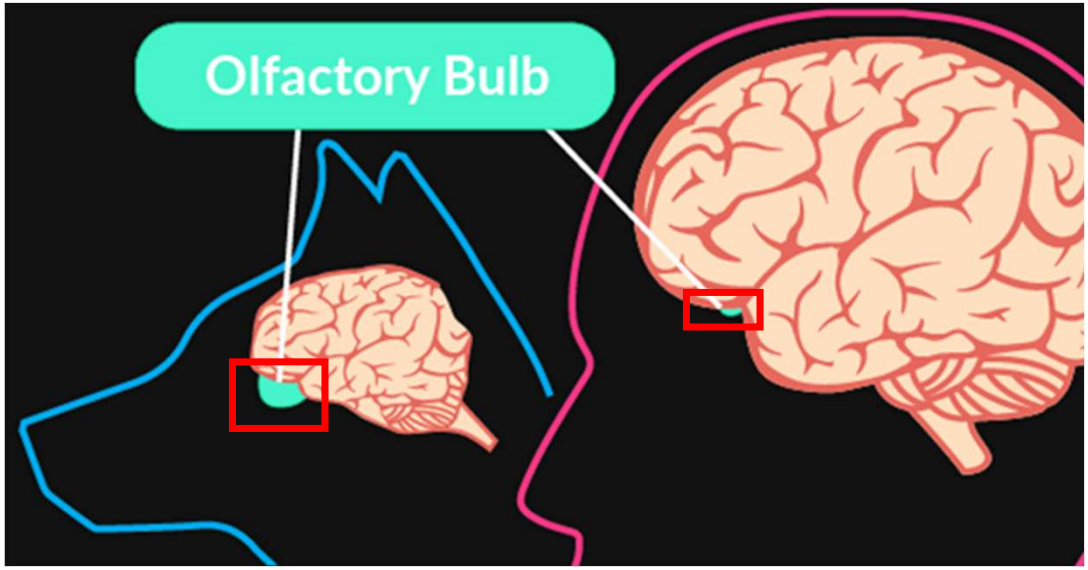
Olfactory Receptors (OR)

Dogs
800 genes
300 million OR expressed



Humans
400 genes
6 million OR expressed

Dogs are able to detect a wide variety of molecules with impressive accuracy

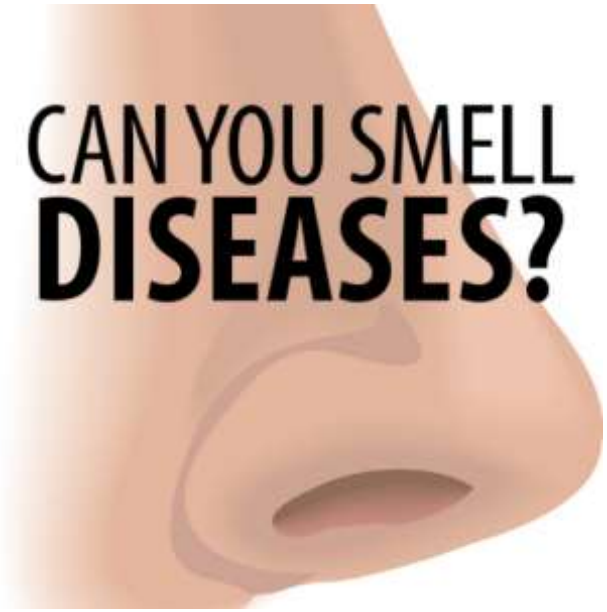


Dogs are able to scent with accuracy :

- Breast cancer via breath smelling
  - Ovarian cancer via tissue or blood smelling
  - Prostate cancer via blood, stool or urine smelling
  - Lung cancer via breath smelling
  - Colorectal cancer
  - Other types
- Various infections (Covid, etc)
- Parkinson Disease
- Other odours enabling patient monitoring such as epilepsy seizure

---> Is it feasible to miniaturize this into a reliable diagnostic device?

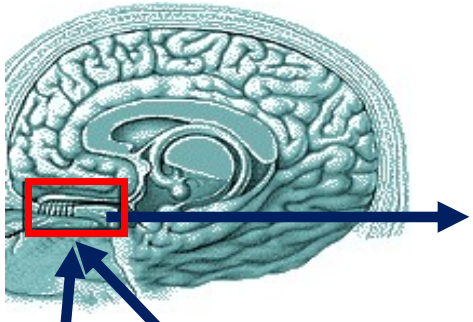
The ability to accurately smell diseases

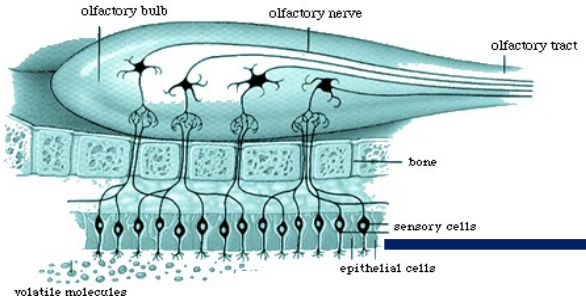


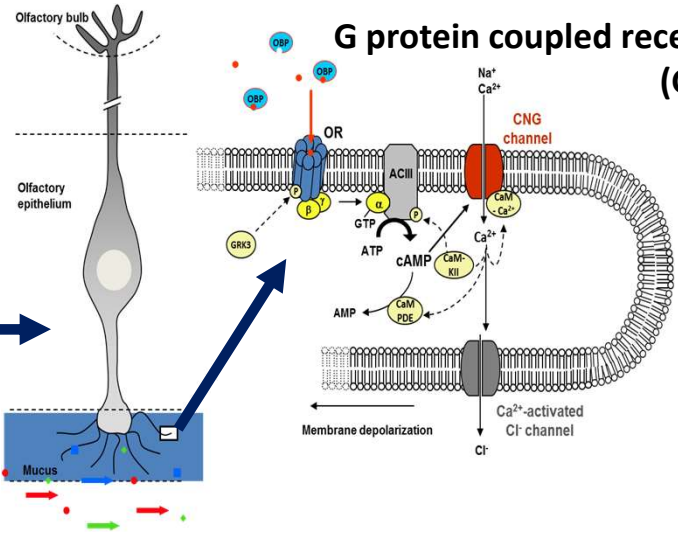
- **Disease will alter / change metabolism, leading to a change of the VOCs emitted by the patient**
- **In addition, diseases will also change the host microbiota and modify the host emitted VOC profile**
- **Diseases might be perceived by smell**

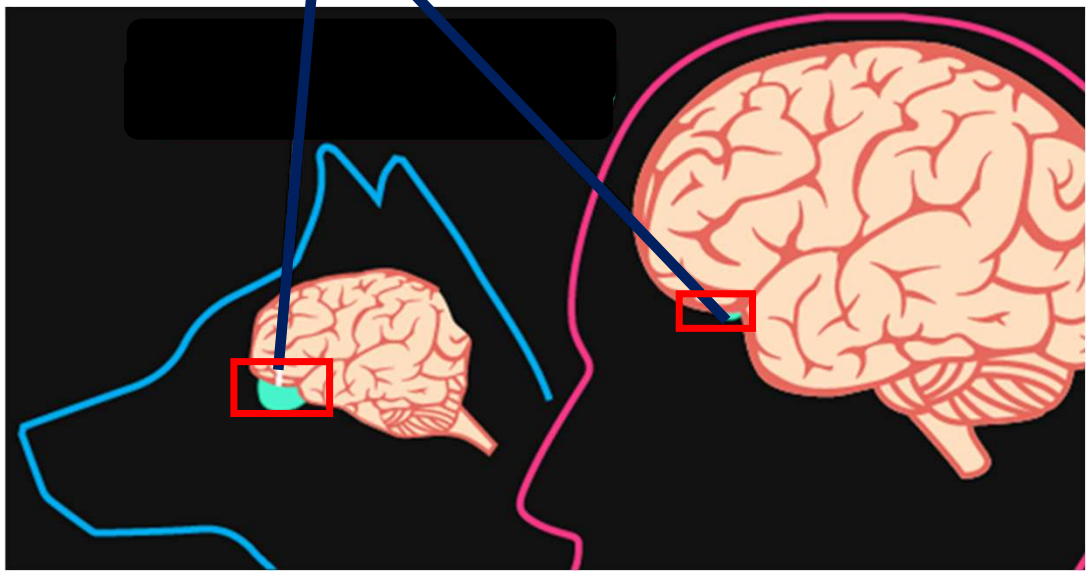
Mammals share same mechanism of Olfaction :
How a chemical signal is transformed into an bio-electrical impulse

Olfactory bulb









Volatiles ---> sinus ---> olfactory epithelium

---> Nasal mucus with olfactory neuron's cilia

---> Interaction between odorant compound and olfactory receptor

---> Cascade of signals and activation of adenylate cyclase : cAMP

---> Influx of Calcium within the cell via a CNG channel

---> Membrane depolarization up to higher brain area

---> Information will be decoded in sensory perception

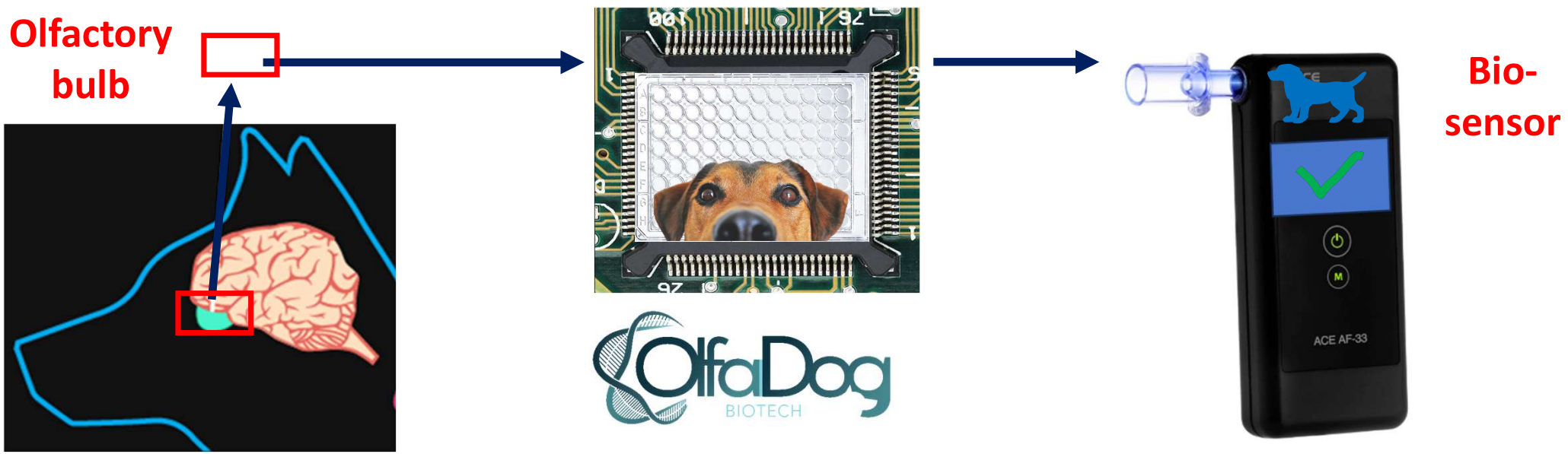
Can canine olfaction be replicated in diagnostic tools?

Purpose :

Develop a miniature model of canine olfactory bulb function using synthetic biology—without involving dogs

To convert odors perceived by dogs into bio-electrical impulse

These impulses are converted in numeric values ---> a bio-sensor

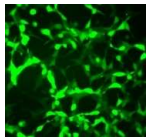


Concept of a biosensor based on canine olfaction

Canine genome database

Synthesis of canine DNA coding for 800 canine Olfactory Receptors (cORs)
! No animal involved, fully synthetic

Cell culture



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Plasmid transfection

Olfadog is able to transiently express canine ORs in cells

High-Throughput Screening (HTS)

24 hours

Chemical stimulation

Breath or urine of humans with various pathologies

Activation of cOR

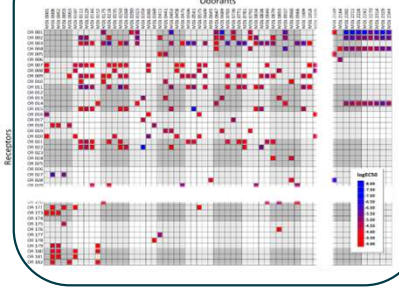
Measurement of Cor activity

cAMP measurement:
- Cre-Luciferase
- HTRF

Calcium imaging:
- CNG
- G chimeric

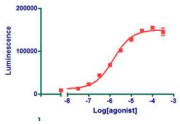
4 complementary assays

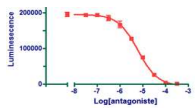
Olfactogram



Analysis and selection

Search for the speficic canine cOR activated by a specific pathology





Integration of canine OR into portable detection tool

Early detection & early medical therapy

OlfaDog
Medical
Detection tool

Detection

Cancer

Epilepsy

Parkinson

There is a rising trend in the number of cancer and Parkinson's disease cases globally

---> science of olfaction can help detect major pathologies possibly before symptoms appear, which could greatly improve treatment and survival rate.

Once again, it highlights the essential role of olfaction in life

Summary :

Pioneering Olfactory Technology for Very Early Diagnosis of Diseases

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Canine genome database

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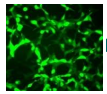

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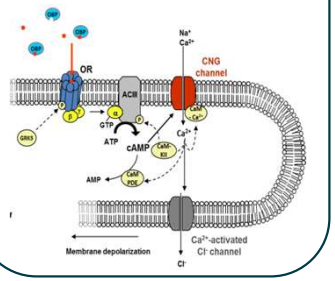
Activation of cOR

G protein coupled receptors (GPCR)



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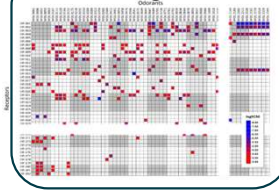

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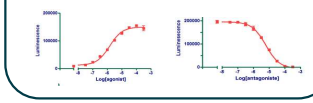
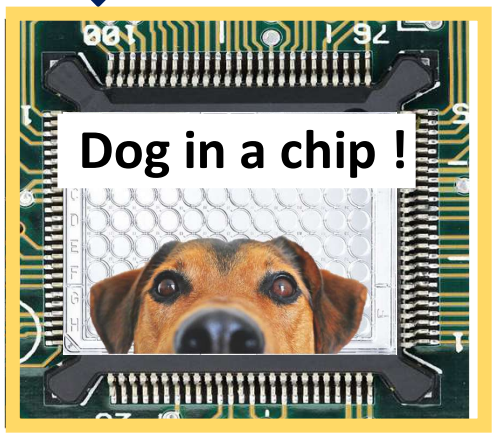


Integration of canine OR into portable detection tool

Early detection & early medical therapy



Purpose : biosensor based on canine olfaction

This process is completely free of animal intervention

Human breath / urine / sweat / blood

Early diagnosis (and improved treatment) of :

---> Cancers : lung, ovarian, breast, prostate

---> Parkinson

---> Epilepsy (seizures)

Thank you

The Canine Olfactory-based biosensors of OlfaDog Biotech have a wide range of applications other than biomedical.

For more information, please contact

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