

SAMPLING BODY ODOR FOR HEALTHCARE MONITORING:

HOW TO AVOID THE PITFALLS OF INTRAINDIVIDUAL VARIABILITY AND
SAMPLING ENVIRONMENT CONTAMINATIONS

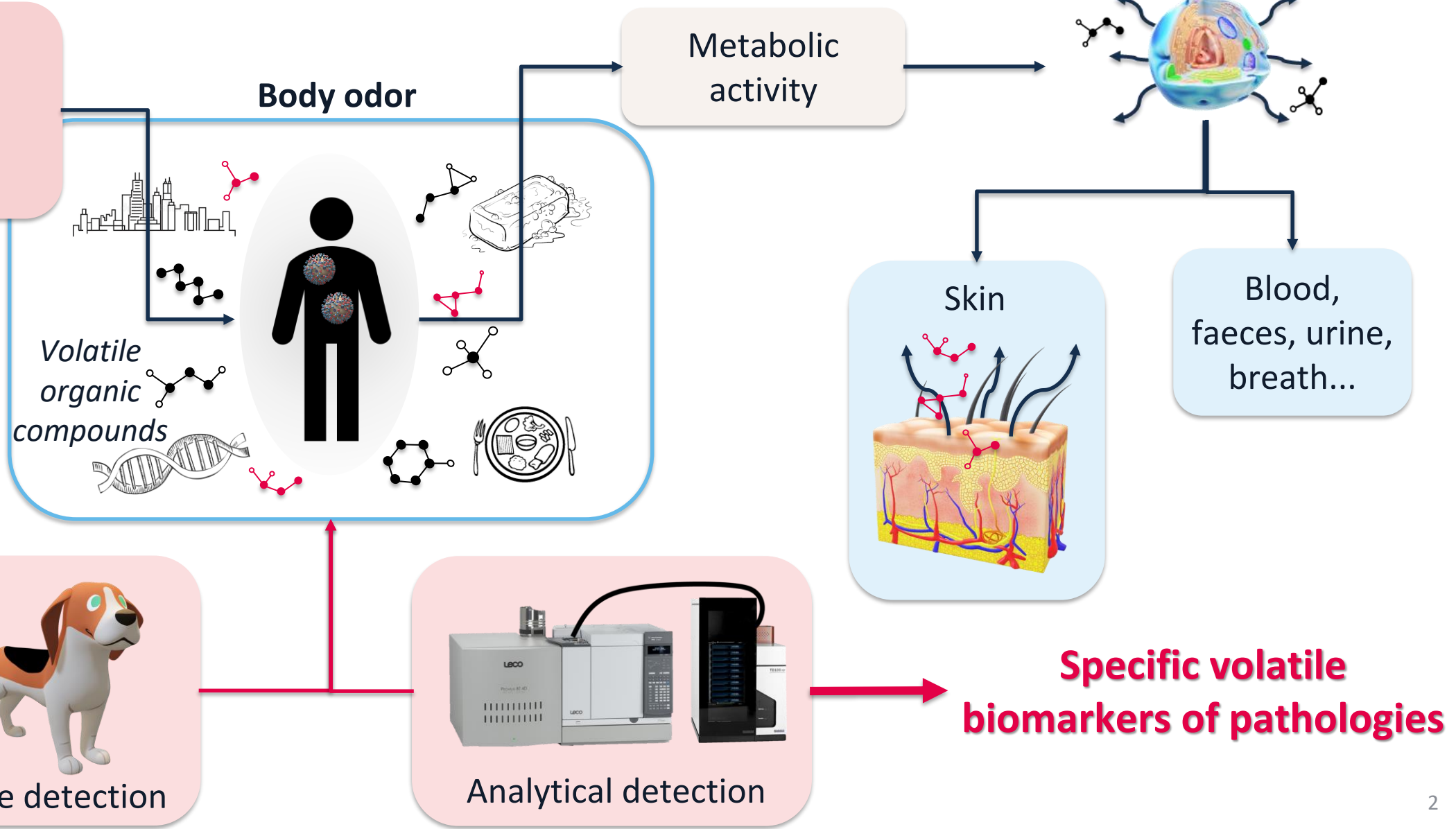
-15TH MULTIDIMENSIONAL CHROMATOGRAPHY WORKSHOP -
ELSA BOUDARD^{1,2}, NABIL MOUMANE², JOSÉ DUGAY¹, JÉRÔME VIAL¹

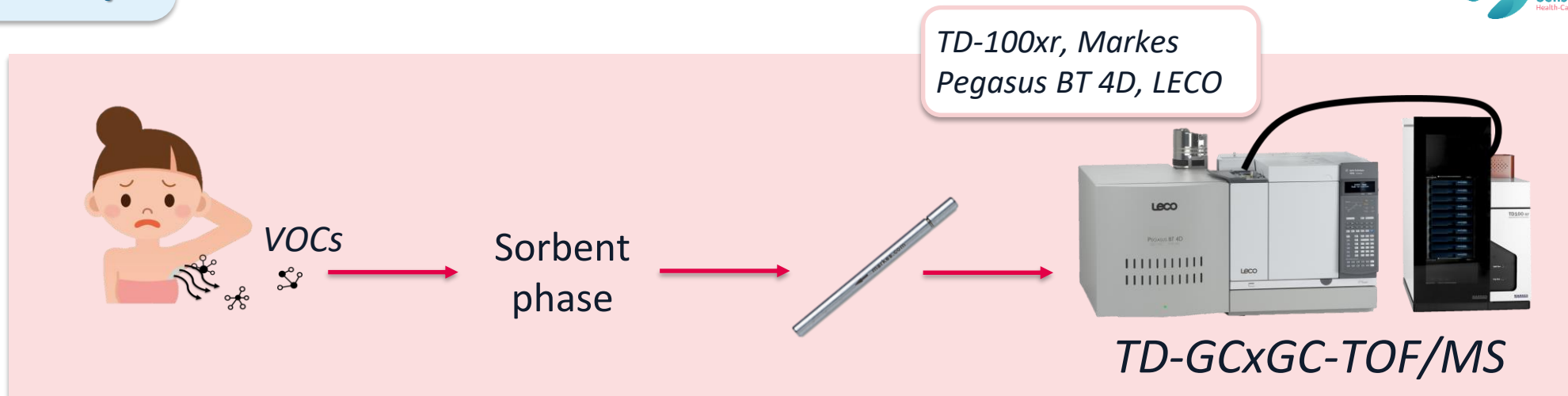
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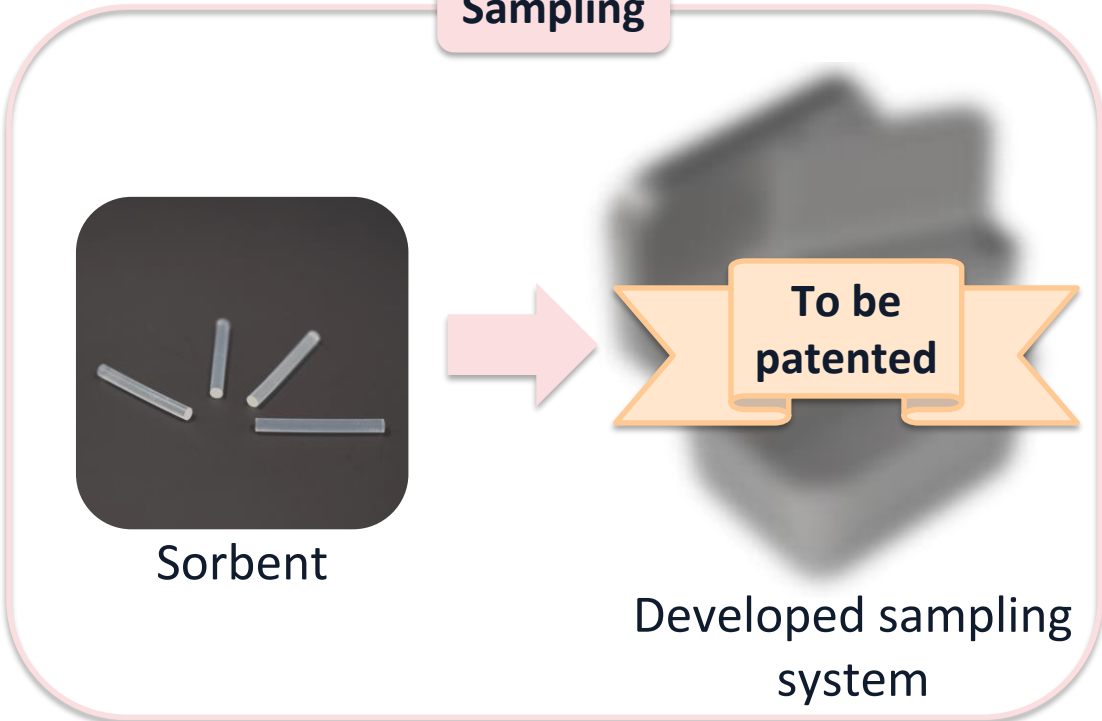
Pathology :

- Diabetes
- Epilepsy
- **Covid-19**





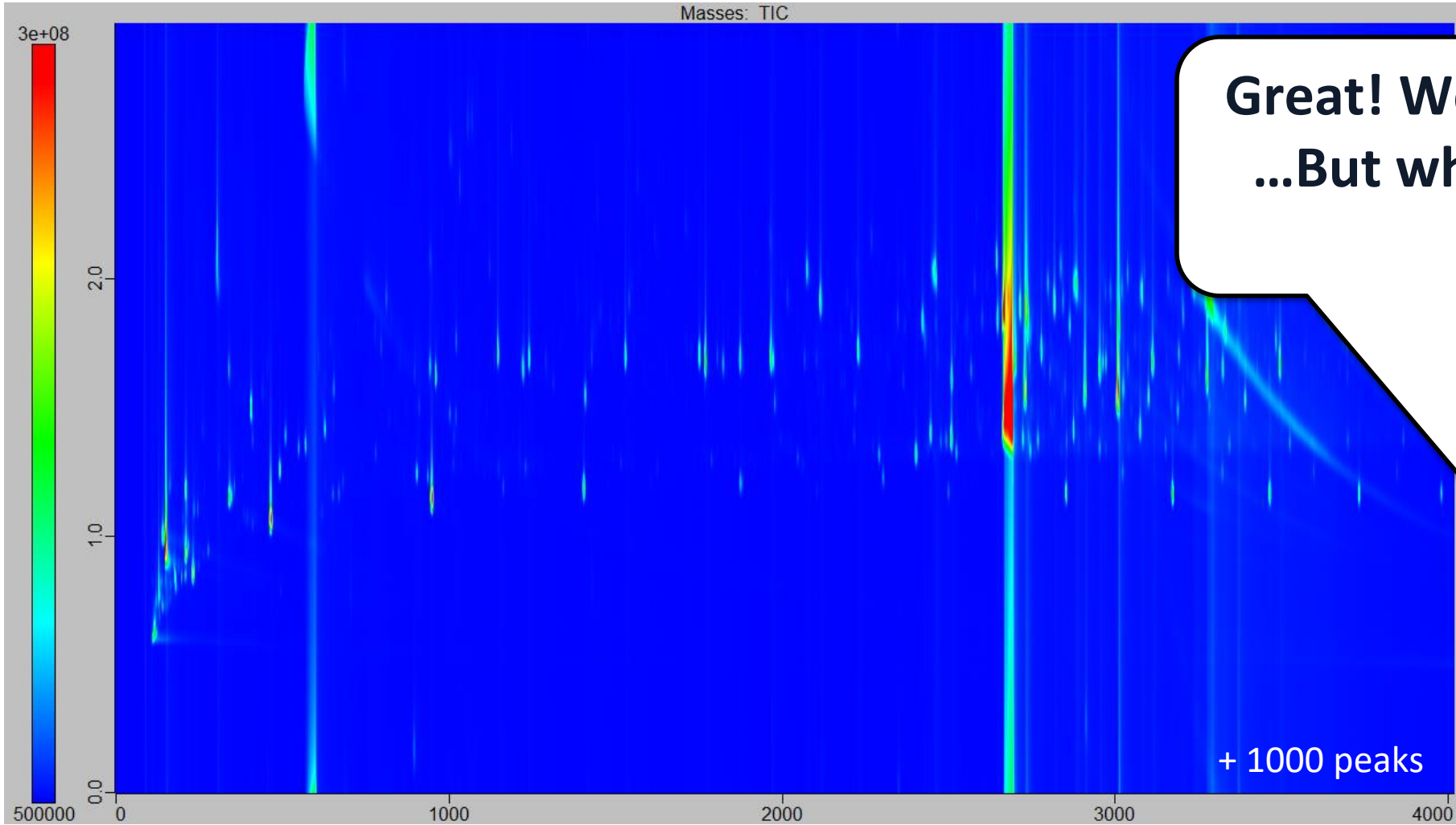
Sampling



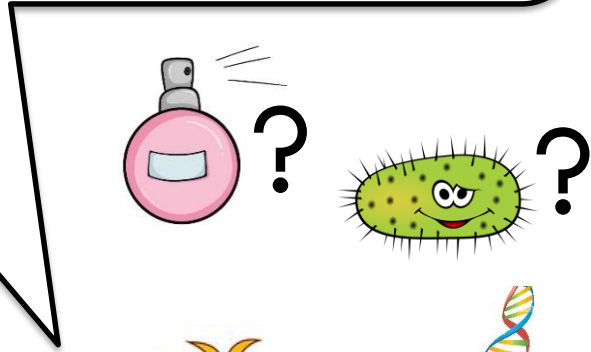
Thermodesorption: 220°C, 20 minutes, He 50 mL/min, split ratio 3

GCxGC: 1D → Rxi-5ms 30 m × 0.5 mm × 0.25 μm
2D → DB1701 50 cm × 0.18 mm × 0.18 μm
Flow → He 1.2 ml/min
Modulation → 3 s (0.9 s hot pulse, 0.6 s cold jet)
35°C to 230°C at 3°C/min, 15°C offset in the secondary oven

ToFMS: Acquisition rate → 200 Hz
Mass range → 45 to 300 m/z



Great! We're seeing things!
...But what exactly do we see?



Body odor sample



Unchanged cosmetic habits → Sampling from the 2 armpits, 3 times a day for one week



Stop using cosmetics (deodorant, perfume) for 24 hours before the first day of sampling and for the rest of the week → Sampling from the 2 armpits, 3 times a day for one week

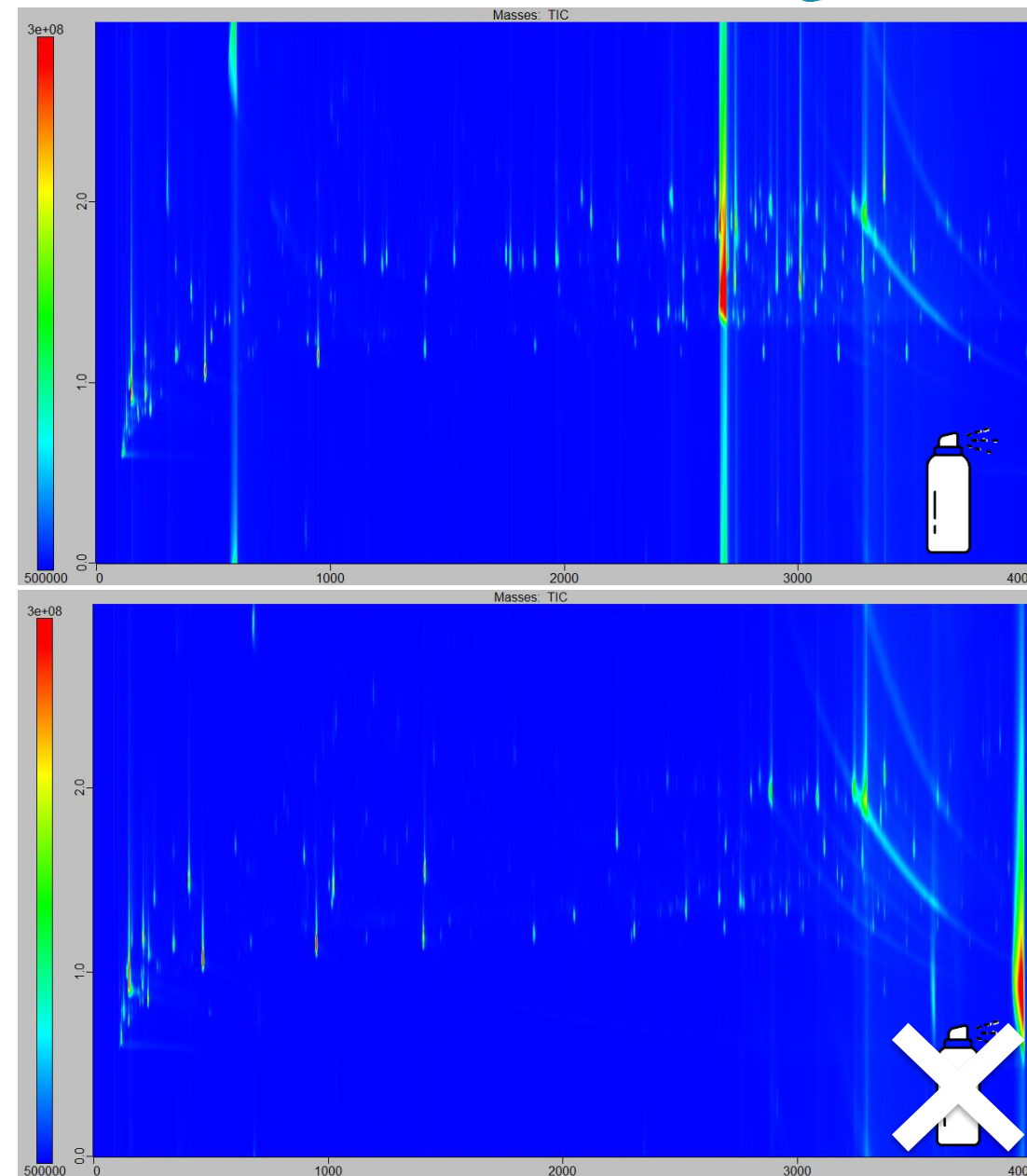
ChromaTOF.Tile

Comparison of 57 chromatograms obtained using ChromaTOF Tile software

Checking results manually via ChromaTOF

203 hits highlighted by ChromaTOF Tile

→ 85 molecules confirmed manually (process of ~ 22h)



Classification of the 85 molecules into categories according to their potential source

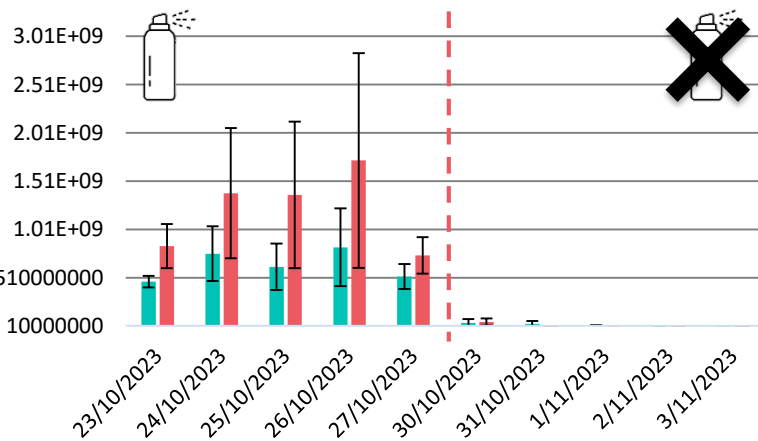
Cosmetics
→ 70 molecules

Bacteria
→ 15 molecules

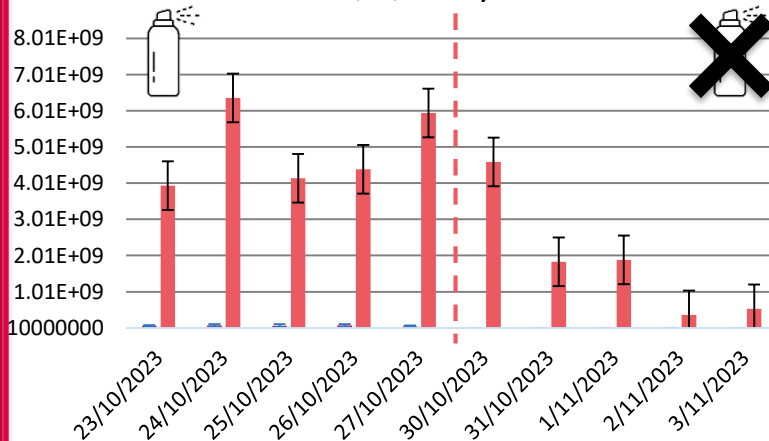
Easily removable cosmetics
→ 64 molecules

Residual cosmetics
→ 6 molecules

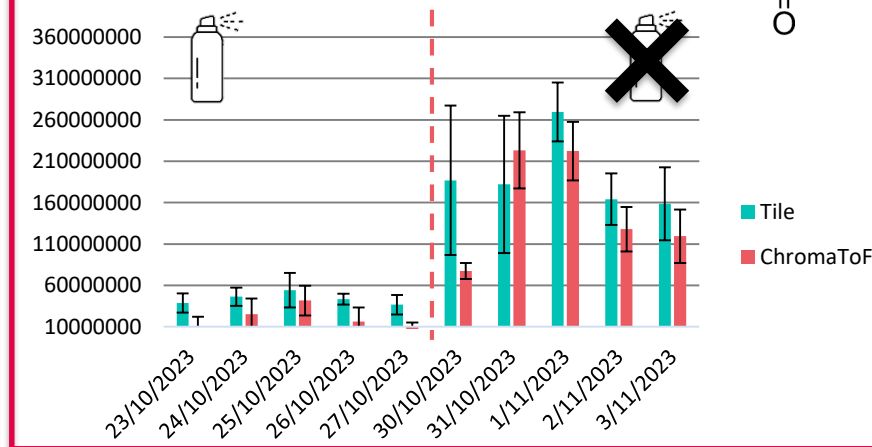
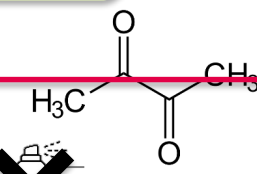
Octanoic acid, octyl ester



Octane, 1,1'-oxybis-

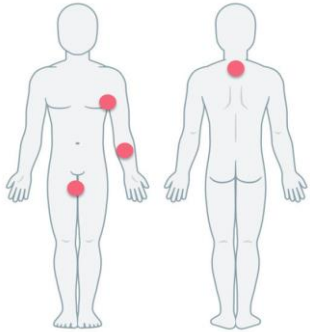


2,3-Butanedione



Cited in the literature as a body odor compound produced by the **bacterial activity** of *Staphylococcus spp* (in vitro study)¹

¹ Takeshi Hara et al. *Suppression of Microbial Metabolic Pathways Inhibits the Generation of the Human Body Odor Component Diacetyl by Staphylococcus spp*



Sampling in 4 different body areas:
armpit, upper back, forearm, groin

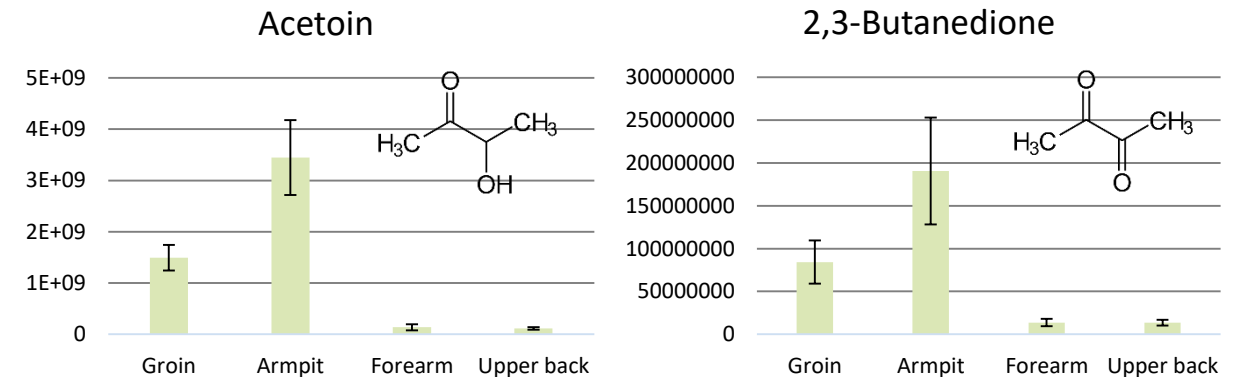
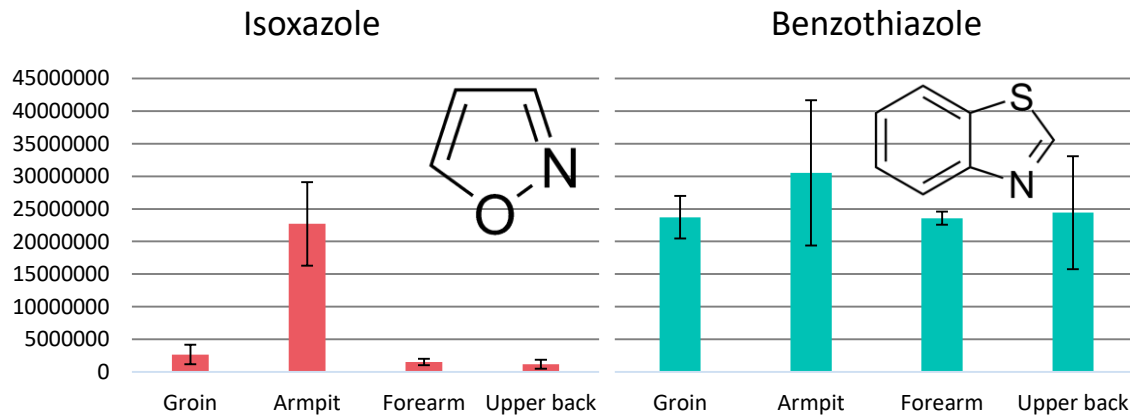
Number of detected compound per sampled body area

Area	Armpit	Forearm	Upper back	Groin
Mean	885	497	655	548
Standard deviation	159	34	130	58

+ 200 additional compounds in the armpit area

Identification of a stable and a variable component within body odor

Search for the 15 molecules identified as pertaining to bacterial activity



➔ Molecules specific to areas with **mucous membranes**, a high density of **sweat glands** and the possibility of **maceration**
5 molecules over 15 are only found in the armpit

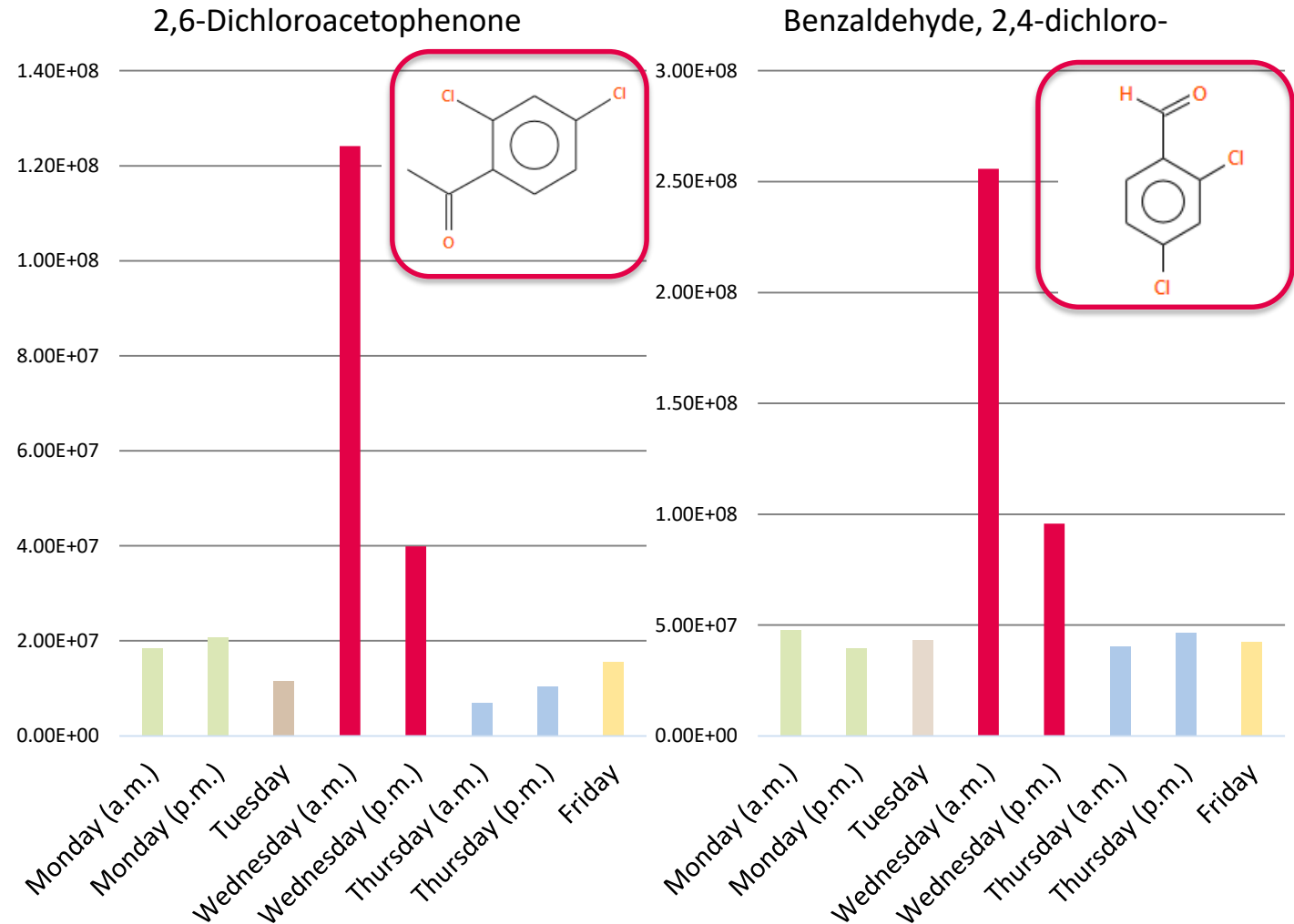


Samples taken from an individual from Monday to Friday

ChromaTOF.Tile

LECO ChromaTOF Tile software was used to identify compounds that vary significantly over the course of the week

What happened between Tuesday and Wednesday for chlorine compounds to appear in the body odor?



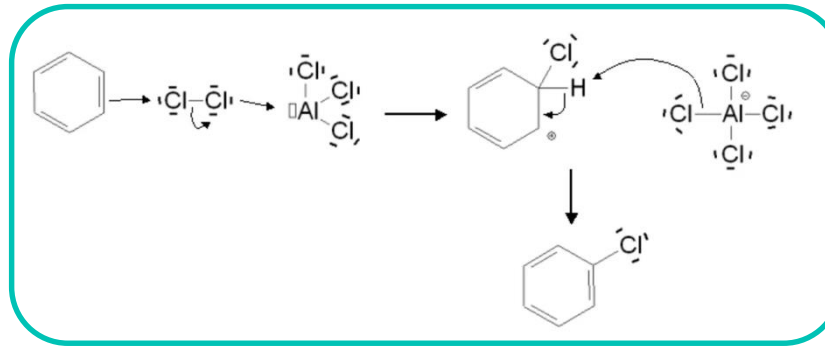
Body odor

Exposure

Tuesday



Wednesday

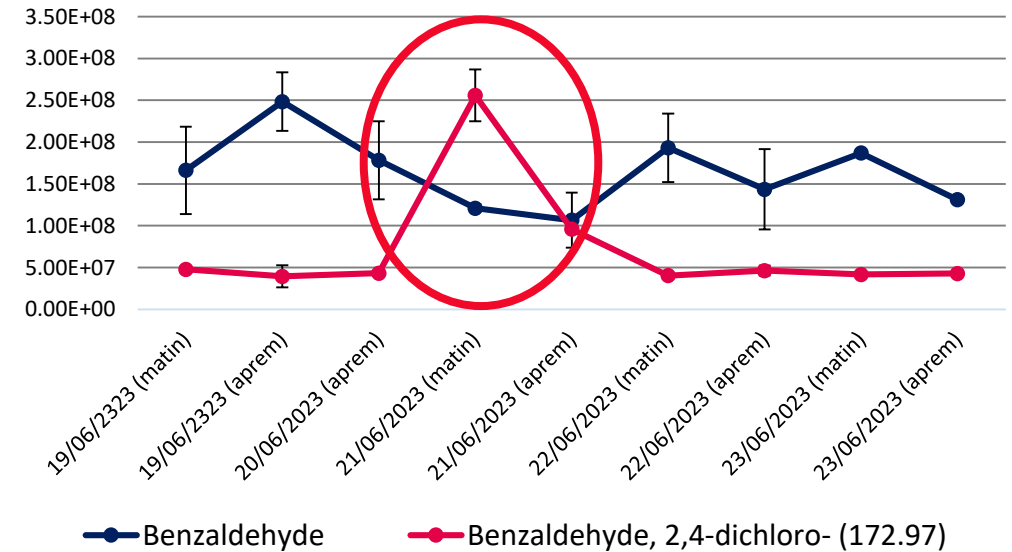
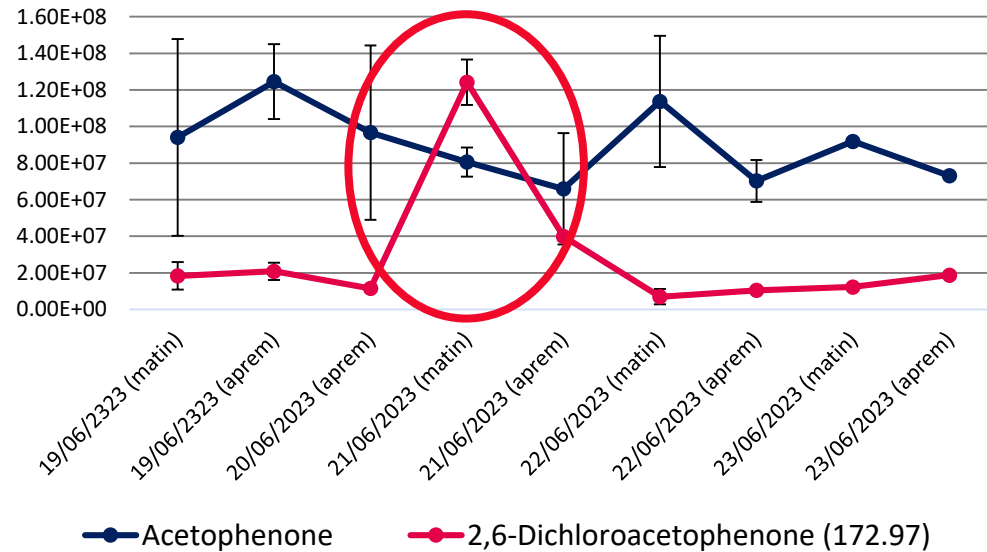


→ Chlorination reaction



All the chlorinated compounds observed were also found in their non-chlorinated form in the individual's body odor samples.

Compound trends over the week:



Consumption of **body odor compounds** and appearance of **chlorine compounds** = consequence of chlorination following **exposure** to pool water



34 Covid (+) = sampled at the **hospital**

→ Armpits, hands and groin



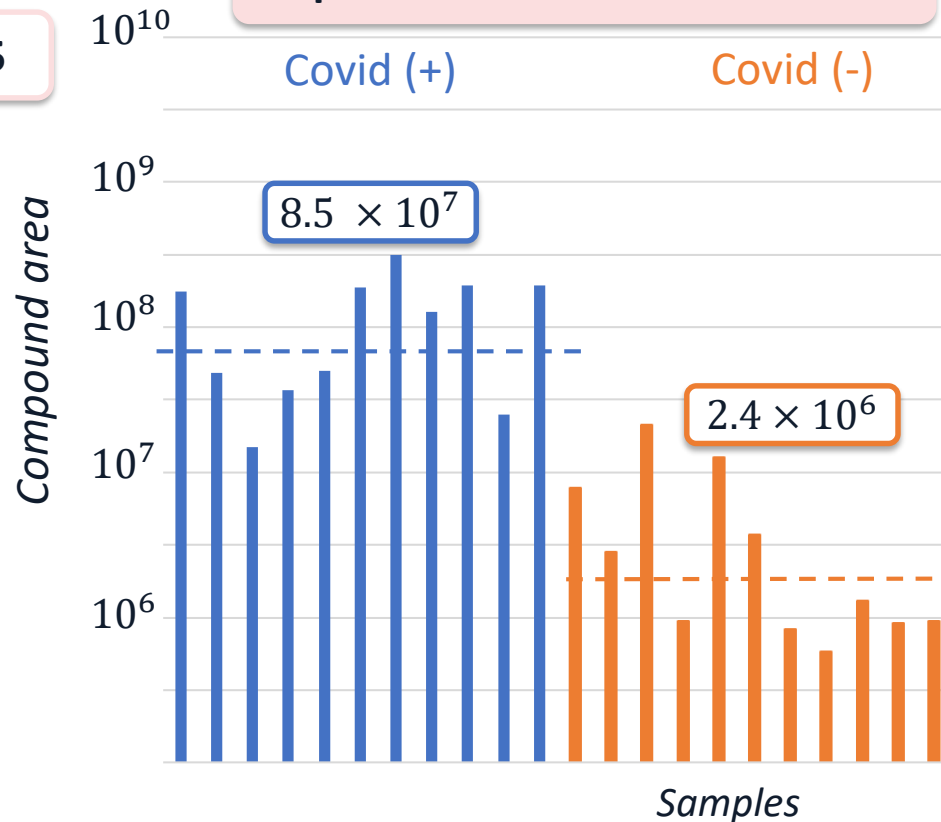
12 Covid (-) = sampled **in our lab or in the canine training center**

→ Armpits

Elaboration of a whole research methodology based on body odor sampling, TD-GCxGC/ToFMS analysis and **chemometrics** (F-ratio, volcano plot)
 → **Only for the armpit samples**

7 potential volatile biomarkers

M15



Marker of the exposure to the hospital environment
NO potential biomarker left

What about dog detections on the same type of samples?



Almost **100% correct detections**, regardless the sampled body area (armpit, hand, groin) for the 10 trained dogs

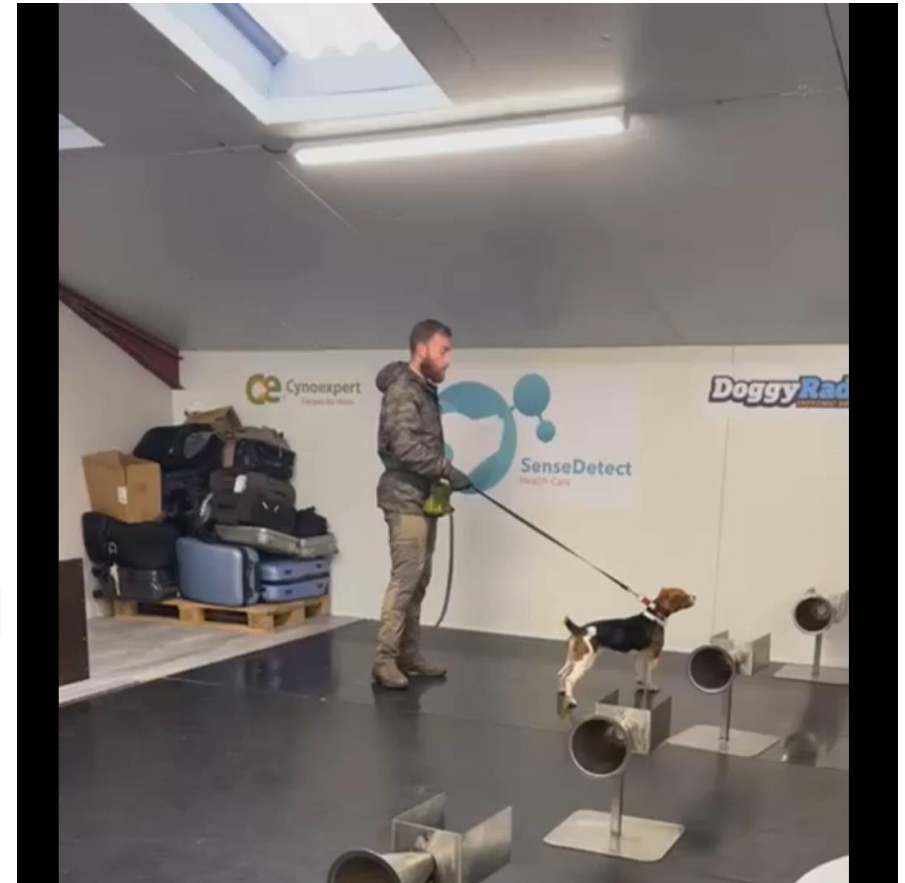
Acquisition of **Covid-negative** samples taken in the hospital



What are the dogs detecting: **Covid** or **hospital environment**?

Still **100% of correct detections**, regardless the sampled body area

There appears to be one or more molecules specific to the pathology and common to the sampling areas

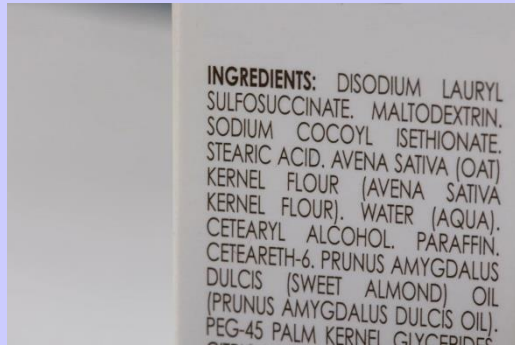


Back to our research methodology, with a new processing:

→ All samples from positive patients were combined in the same group whatever the sampling area

24 new potential volatile biomarkers

12 probably linked to cosmetics
Cited in cosmetics studies or compositions



5 potential volatile biomarkers

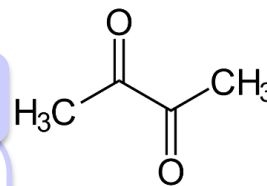
To be confirmed: Covid (+) or exposure to the hospital?
Can be decided using a synthetic odor mixture submitted to canine detection

7 probably linked to surrounding environment
Overexpressed in Covid (-) group



Better understanding of the body odor matrix

- VOC linked to **cosmetics** or **bacteria**
- **Homogeneity** of the body odor components (**stable** and **variable** components)
- Influence of the **surrounding environment**



Promising results for the Covid-19 study

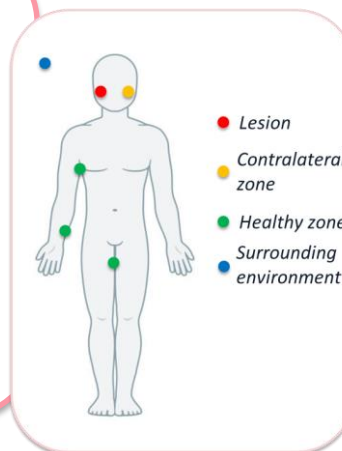
Possibility to **further exploit the results** thanks to the combination of **canine** and **analytical detection**:

- Different needs to achieve reliable results
- **5 potential volatile biomarkers to study**

Coming soon

Clinical study on **skin cancer** with a protocol taking into account all identified bias factors:

- **New sampling device**
- **Cosmetics removal**
- Sampling of the **surrounding environment** + healthy and sick subjects sampled at the **same location**





**Thanks to the LSABM team, SenseDetect
Health-Care and the collaborators!**

Thank you for your attention!