ESPCI PARIS | PSL

TOWARDS A BETTER UNDERSTANDING OF THE BODY VOLATOLOME: FOCUS ON ENDOGENOUS PARAMETERS INFLUENCING BODY VOLATOLOME COMPOSITION

-16TH MULTIDIMENSIONAL CHROMATOGRAPHY WORKSHOP –

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16TH Multidimensional Chromatography Workshop

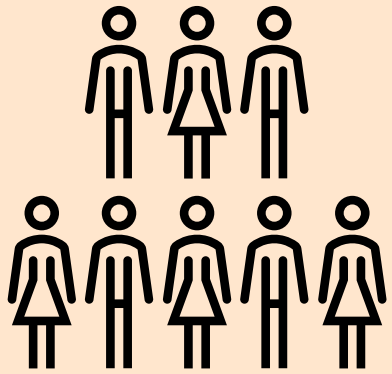
SenseBioTek HEALTHCARE

VILLE DE PARIS

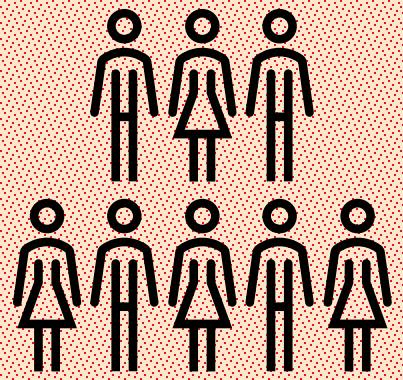
Designing a clinical study

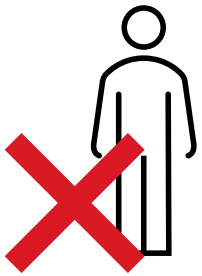
Skin cancers

Healthy cohort



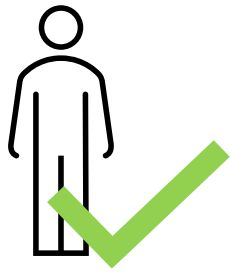
Sick cohort





Exclusion criteria:
Patients with inflammatory skin diseases

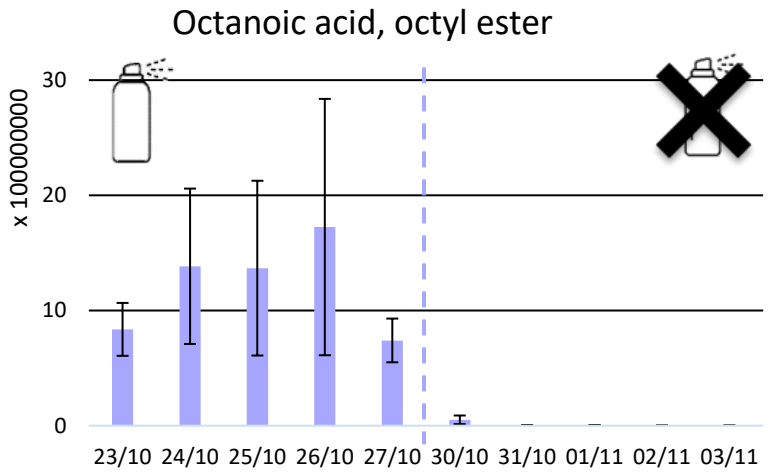
Inclusion criteria:
Has a diagnosis of skin cancer established by imaging such as confocal microscopy or LC-OCT more than 24 hours old



Designing a clinical study

What about other factors influencing the body odor?

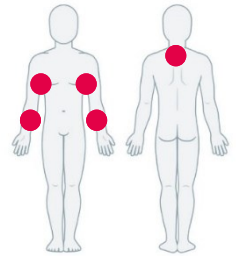
Exogenous influence



Inclusion criteria:
Subject who has not used cosmetic products such as deodorant or perfume in the 24 hours prior to sampling

Endogenous influence

19 individuals sampled



Body area sampled

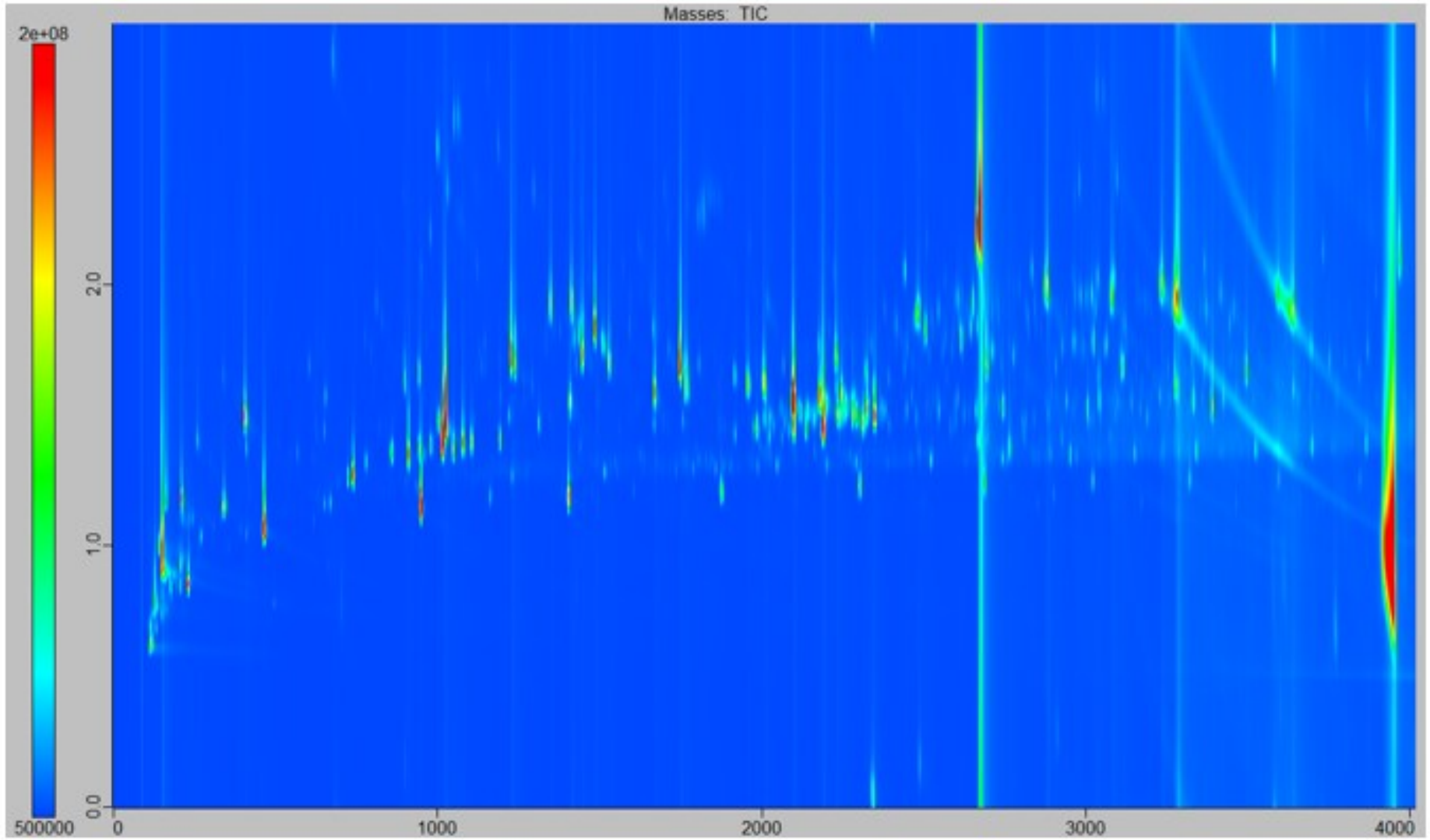
6 men (M) 13 women (W)
15 < 40 yo (40-) 4 ≥ (40+)

Gender Age

Sampled during 1 hour with SkinVOCs®

See poster P-40

Designing a clinical study



Chromatogram of skin body volatolome

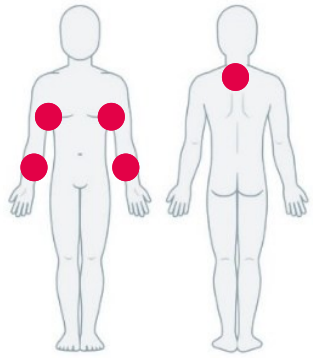
Comparison of groups using a mixed method (targeted + non-targeted)

Molecules from the literature
+
molecules highlighted by ChromaToF Tile

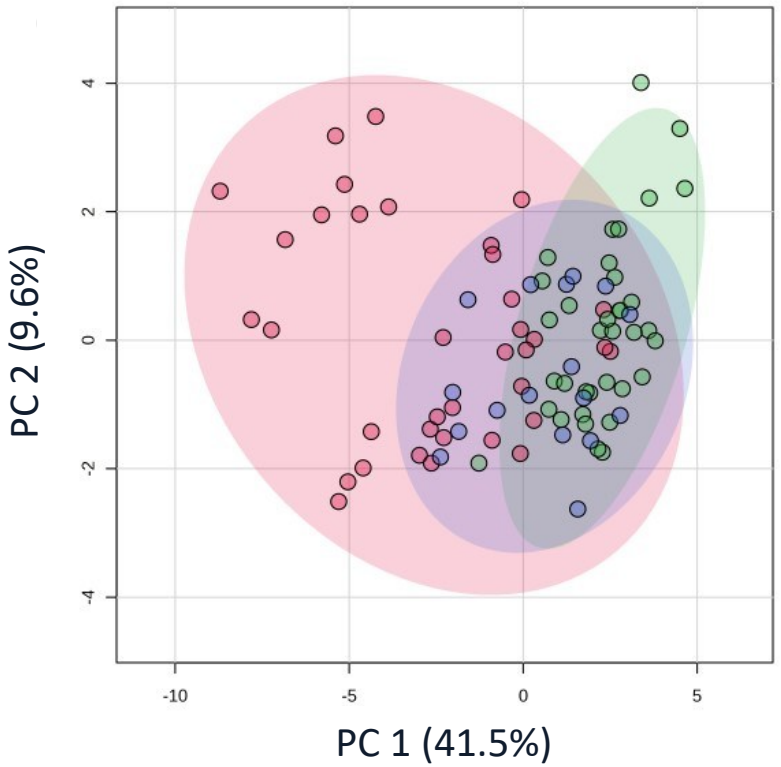
Chemometric tools: Principal Component Analysis (PCA) + Partial Least Squares Discriminant Analysis (PLS-DA)

Body area sampled

- Armpits (A)
- Forearm (F)
- Back (B)

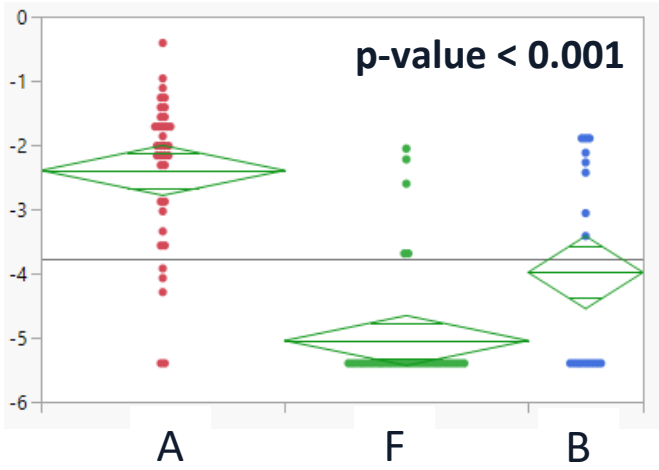


p-value (obtained by PERMANOVA) = 0.001



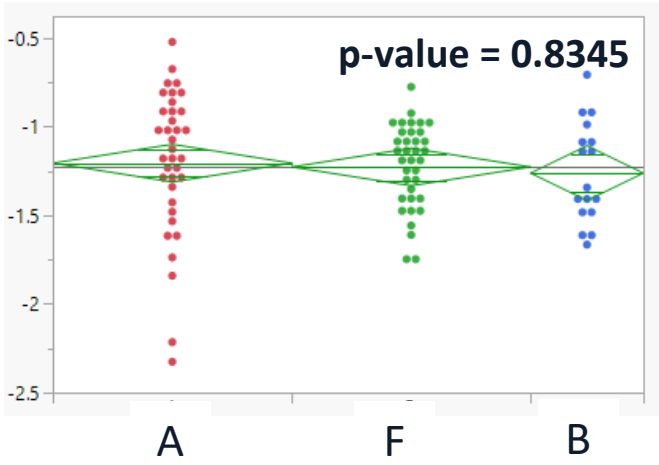
PCA results

Benzenemethanethiol



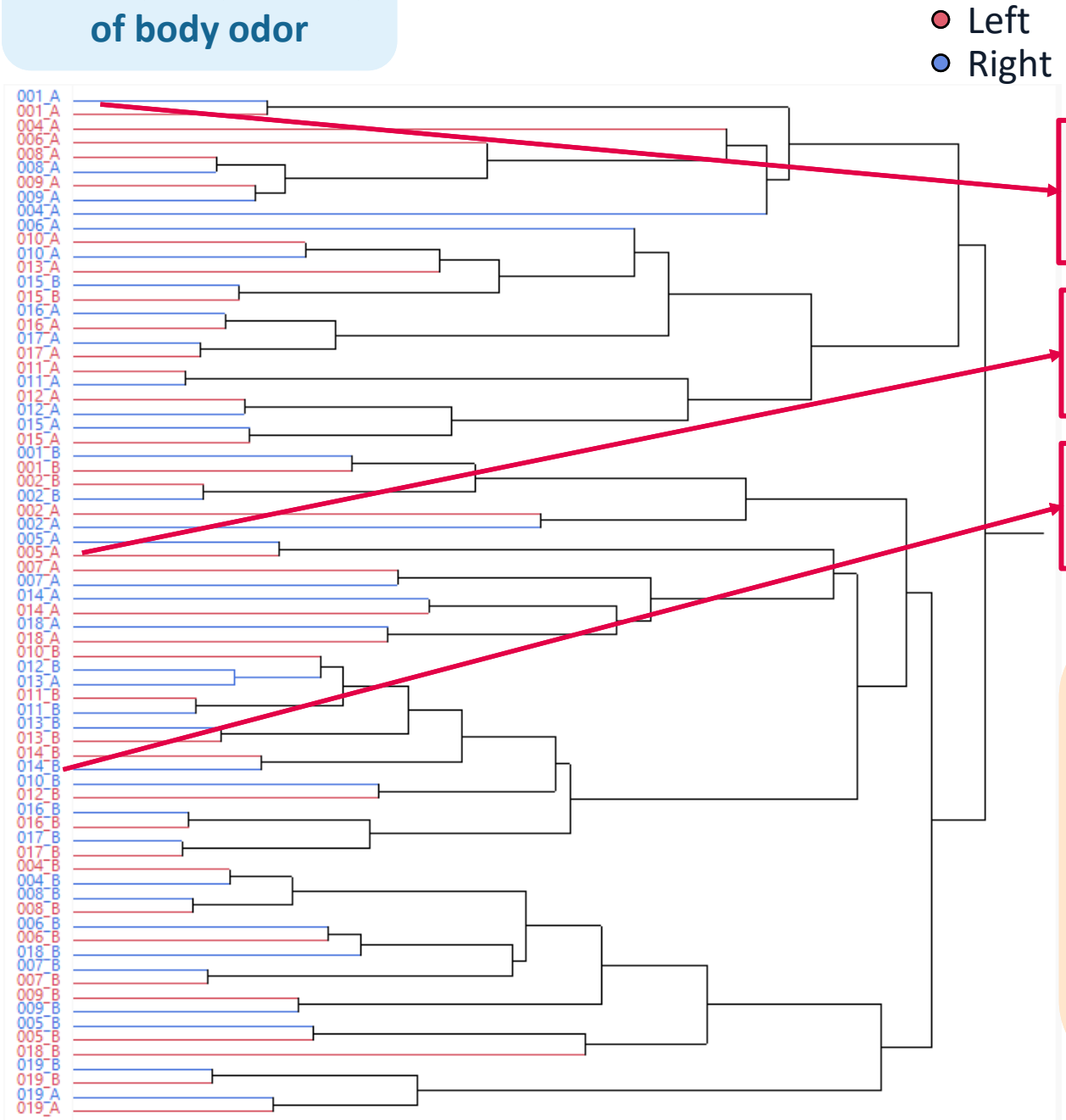
Body volatolome compound **specific** of a body area

Benzyl alcohol



Body volatolome compound **common** to the 3 sampled body areas

Left/right symmetry of body odor



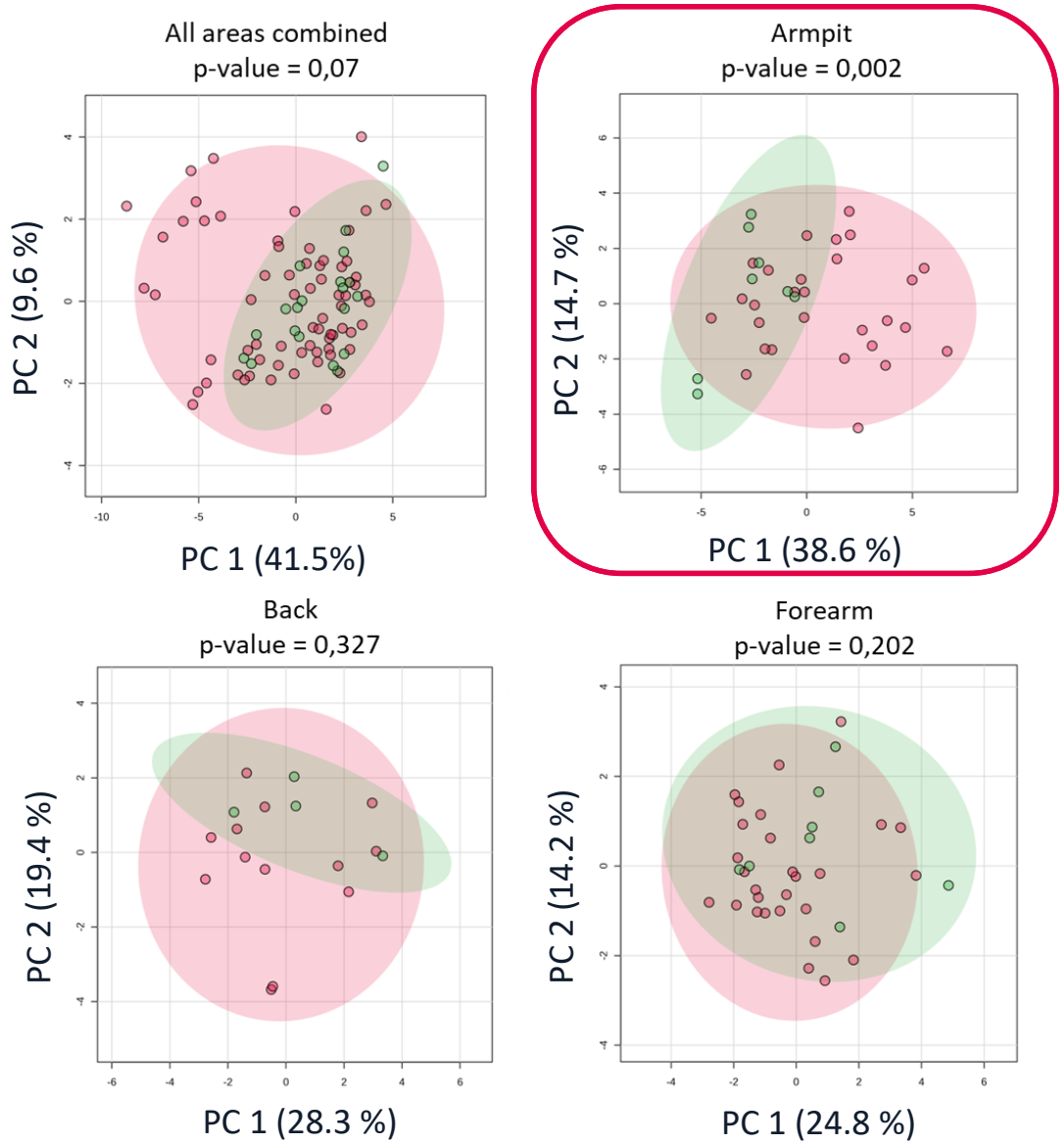
15/18 pairs of samples brought together at the first level of analysis

= Better left/right similarity between samples from the same individual than with samples from other individuals

➔ **Possibility to use left/right samples as replicates**

Age influence

- 40-
- 40+



➔ Age group differentiation thanks to molecules emitted by the **armpits** (**apocrine glands**)

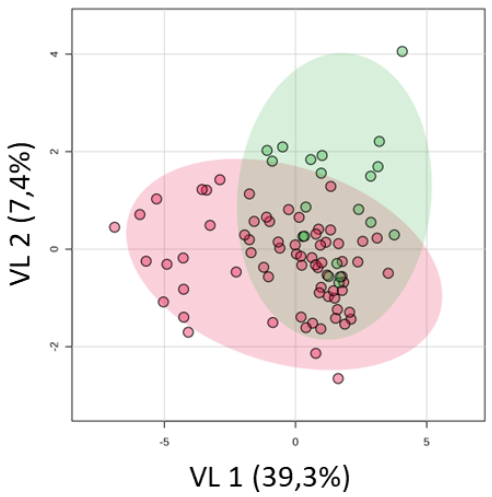
p-value threshold = 0.01

PCA results

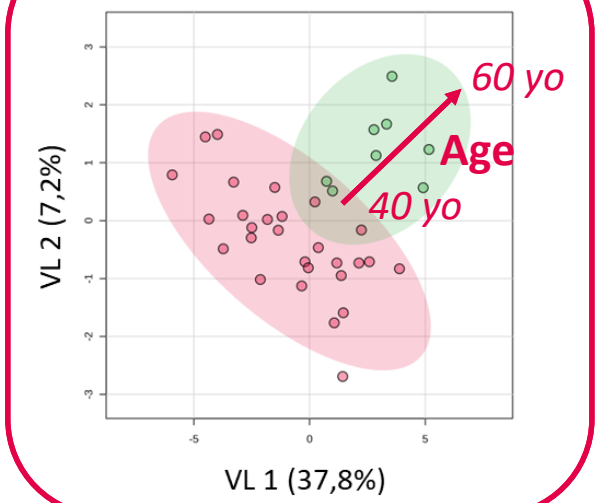
Age influence

- 40-
- 40+

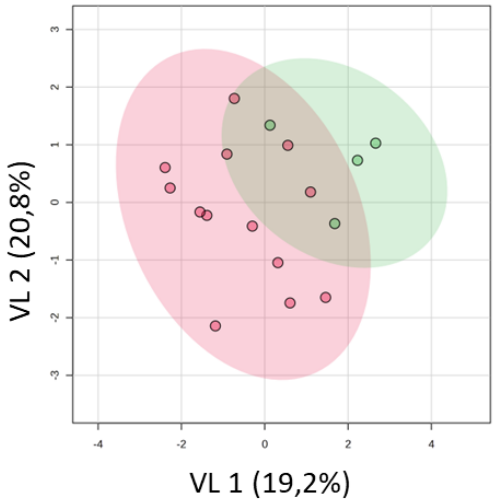
All areas combined



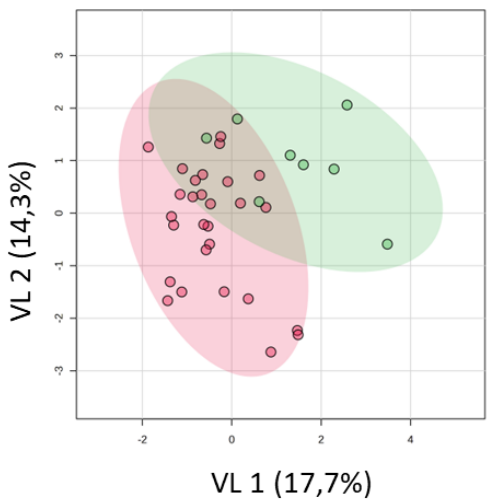
Armpit



Back



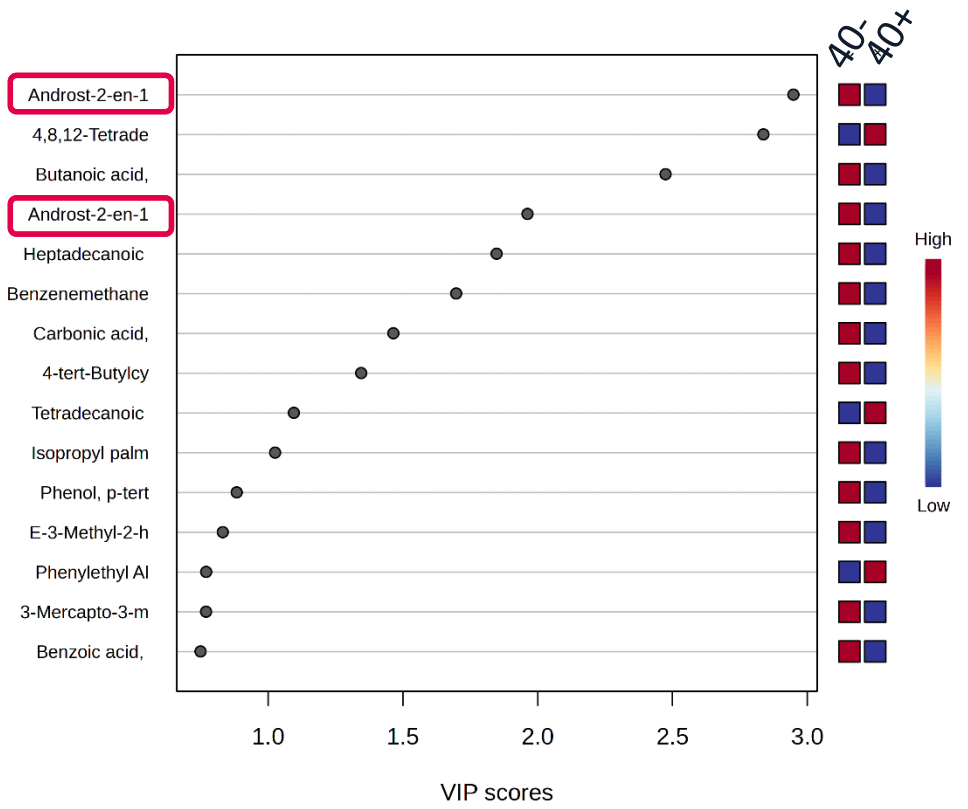
Forearm



PLS-DA results

➔ Visually, better separation of groups thanks to the **supervised method**

➔ Similar variables of importance in PCA and PLS-DA

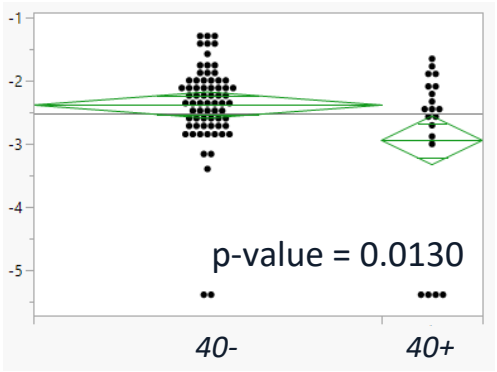


Steroids more prevalent in the under -40s

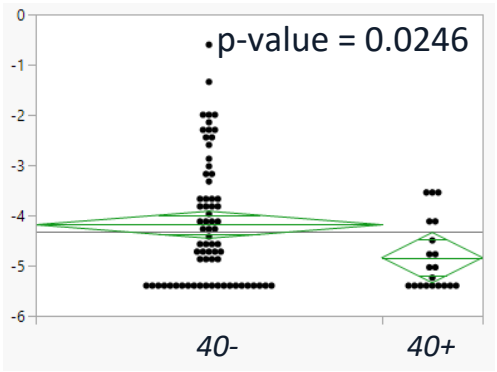
Age influence

ANOVA on the 8 molecules contributing most to the distinction between age groups in PCA and PLS-DA

E-3-Methyl-2-hexenoic acid



Androst-2-en-17-ol, (5α,17β)-

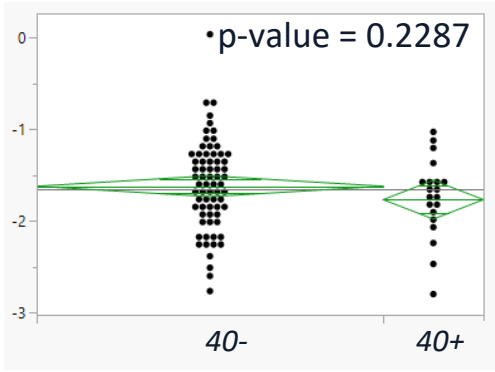


No p-value < 0.01 but for 3 molecules p-value < 0.05

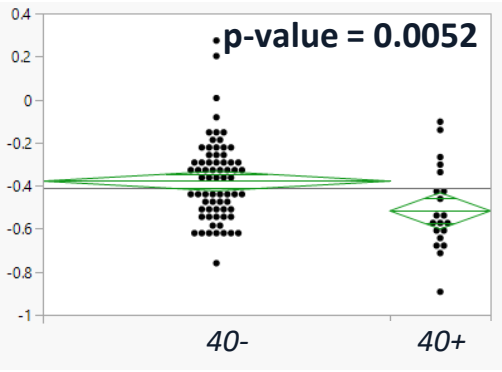
➔ **All molecules contribute to differentiation**

ANOVA on the 4 molecules coming from the literature

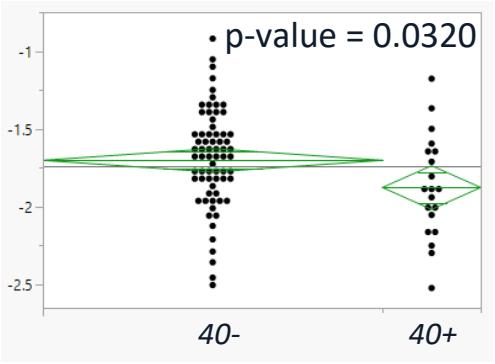
Dimethyl sulfone[1]



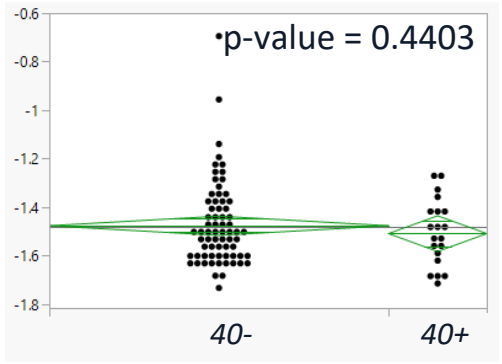
Nonanal[1]



2-Nonenal, (E)-[2]



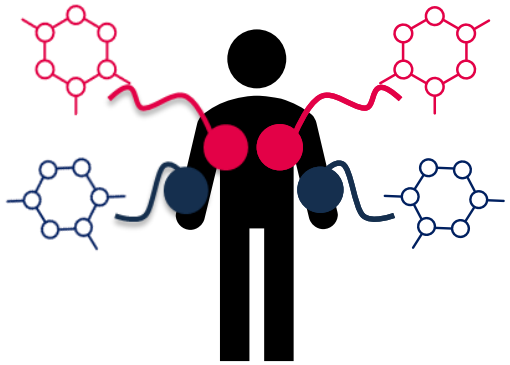
Benzothiazole[1]

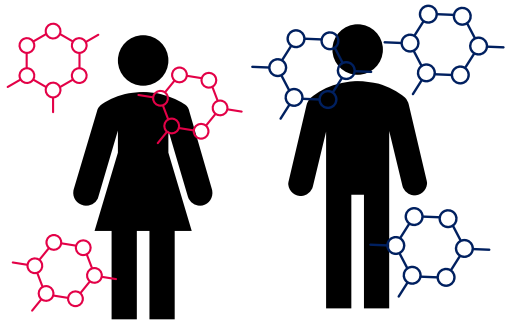


Significant between groups but inverse trend to the literature

[1] Gallagher M et al. The British Journal of Dermatology (2008)
[2] Haze S et al. The Journal of Investigative Dermatology (2001)

Conclusion

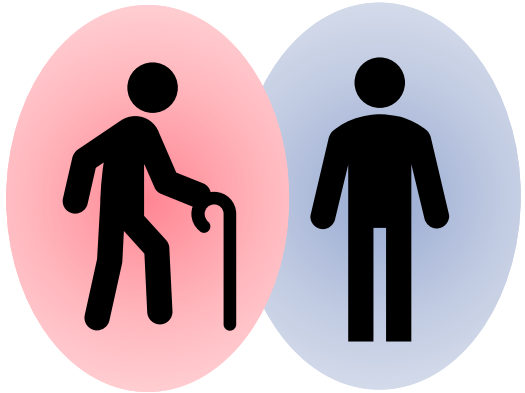




Differences in the composition of the body volatolome depending on the **sampled body area** BUT **left/right sides** of the body are comparable

Differentiation of 40- and 40+ ➔ use **a set of molecules**

Differentiation of W and M ➔ some **specific molecules**



Need to confirm these results using **larger cohort** + **balanced**

➔ Endogenous parameters influence the composition of the body volatolome

Recommendation:
Age and gender-matched subjects for clinical studies

SkinVOCs® : An innovative sampling system for body odor prior to TD-GC×GC-ToFMS analysis

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SenseBioTek Health Care — ESPCI PARIS PSL — CBI

Introduction

he **cutaneous body volatolome (CBV)**, or body odor, is a ixture of volatile organic compounds (VOCs) with potential as iomarkers for **non-invasive** and **early** disease **diagnosis**. ue to the complexity of CBV, advanced analytical techniques uch as TD-GCxGC-ToFMS are essential for a precise molecular lentification. However, the **sampling step**, which is critical for eliable analysis, lacks standardization in current literature. We troduce here a new and innovative system for exhaustive CBV ampling.

Our sampling solution : SkinVOCs®

A system designed to ensure effective VOCs collection while maintaining analytical cleanliness

Benefits

Ease of use
User-friendly
Low contamination
Flexible

Sampling System SkinVOCs® : procedure of use

1/ Conditionning

kinVOCs®
se of solvents for cleaning
trasonic baths to remove
sidual contaminants

Adsorbent
eat treatment
as flow to ensure clean
lsorption surfaces

2/ Sampling

Holder containing adsorbent

Gripping handle

Fixing patch
Applicable on various skin areas

3/ Analysis

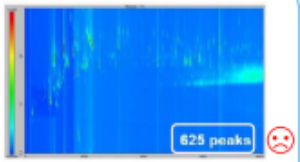
TD Tubes stainless steel

Colonne 1 : Rxi-5ms, 30 m * 0,5 mm * 0,25 µ
Colonne 2 : DB1701, 50 cm * 0,18 mm * 0,18
35°C for 2 min then 3°C/min up to 230°C
Modulation cryogenic, 3s

Ensuring quality : Why blanks matter

Blanks are essential to avoid contamination and guarantee reliability

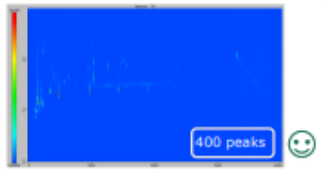
Analytical result of blanks for raw gauze



Blanks for raw gauze : Not clean
difficult to distinguish blanks and real samples

Limited step condition : 100°C desorption due o poor heat resistance, resulting to contaminated blanks with additional peaks.

2 Analytical result of blanks for SkinVOCs



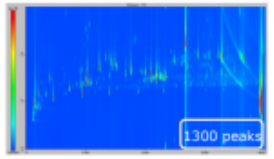
Blanks for SkinVOCs : Clean profile = minimal VOC contamination

Arithmetic mean of total chromatogram peak areas : Blanks = 3×10^{10}

Blanks showed repeatability : **20% RSD (peak areas)** and **17% RSD (peak count)**

Conditioning: Adsorbent heated under a gas stream

3 Analytical result of a body odor sample collected using the SkinVOCs® system



Real sample : Rich profile = reflects sample complexity

Arithmetic mean of total chromatogram peak areas : Real sample = 3×10^{11}
→ A ratio of 10 allows for easy differentiation between blanks and samples

Choice of adsorbent: Lower number of peaks for SkinVOCs®, faciliting data processing

SkinVOCs® : Analytical cleanliness, difference between blank and real sample

SkinVOCs® performances

Pratical

Fast sampling : 1 hour
Applicable on various skin areas : maximum area of 40 cm²
Easy to use : tested by over 20 untrained participants

Efficient

- Representative sample = wide range of affinities for different chemical families
- Detection limit of the overall process, from trapping to VOC detection for all compounds combined = 0.05 ± 0.01 ng

First application

Prototype SkinVOCs® used for clinical study of Covid-19

- Detected biomarkers for Covid-19
- 4 potential biomarkers

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

Thank you for your attention!

For more details on the sampling step: Poster 40 – Kleidisa Rrushka

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