Characterization of the relationship between olfactory perception and quantified compounds as phenotypes for genetic selection against boar taint using a recursive model

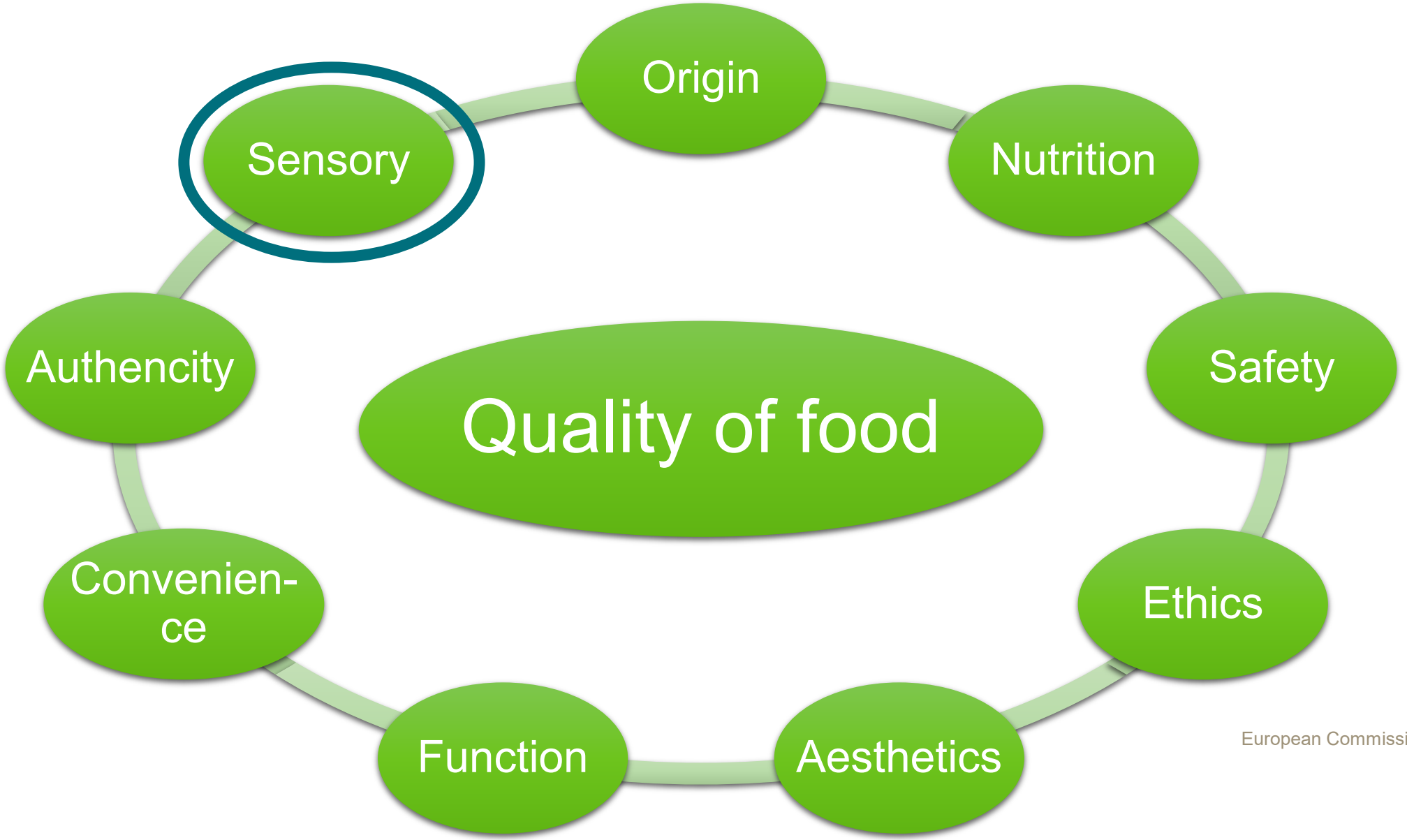
Alice Markey[1], Christine Groβe-Brinkhaus[2], Daniel Mörlein[3], Ernst Tholen[2], Nicolas Gengler[1]

[1]University of Liege - GxABT, Animal Sciences

[2]University of Bonn, Institute of Animal Science

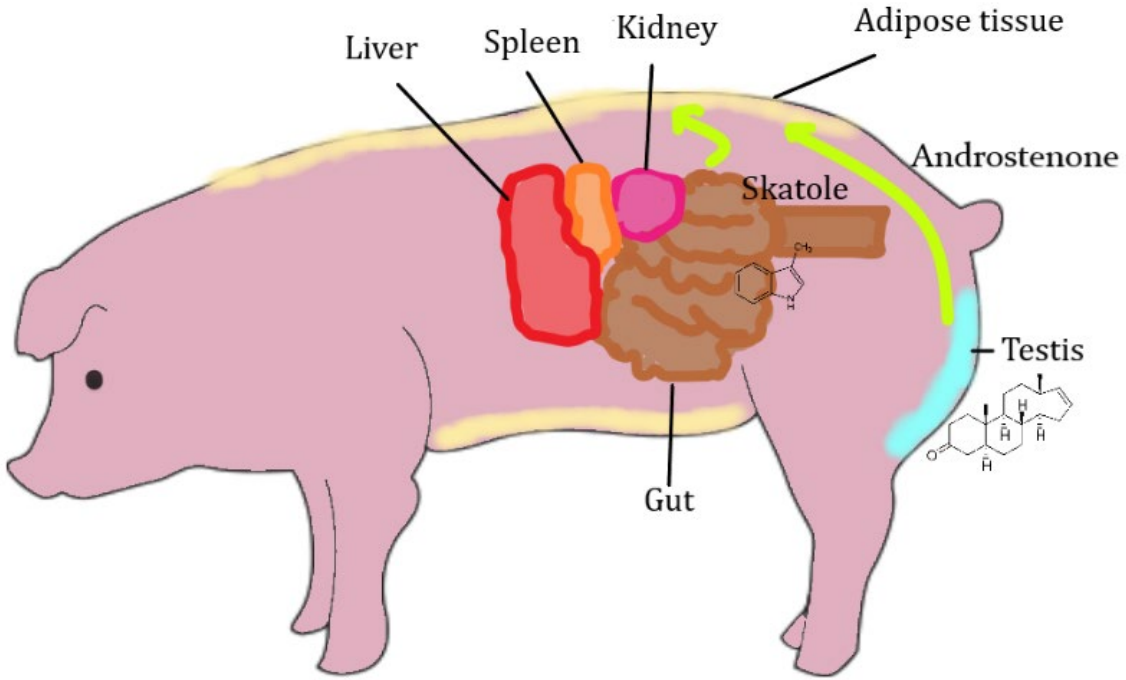
[3]University of Göttingen, Departement of Animal Science

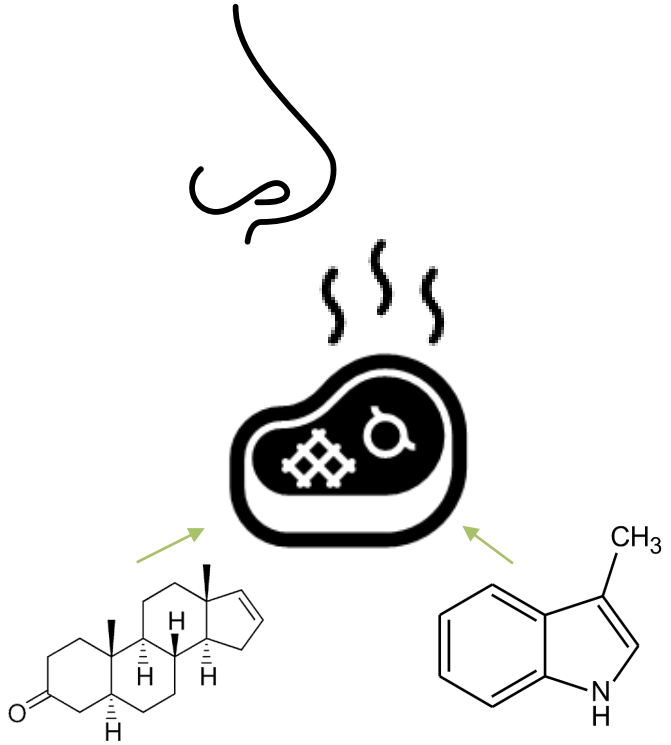
Introduction



European Commission, 2021

Introduction
Boar taint





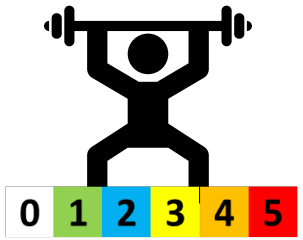
Androstenone

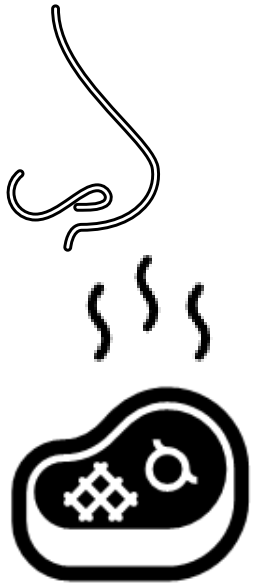
$h^2 = 0.52$

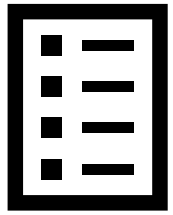
Skatole

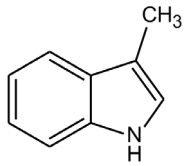
$h^2 = 0.53$

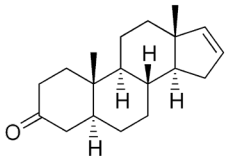
Introduction
Sensory evaluation

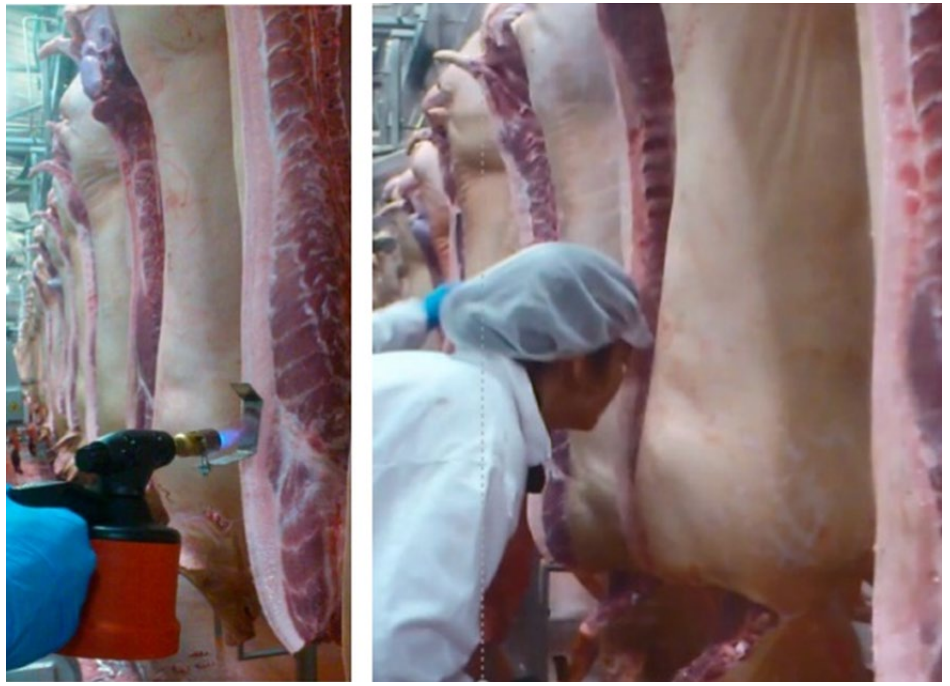






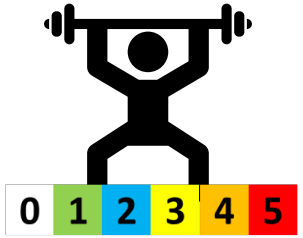


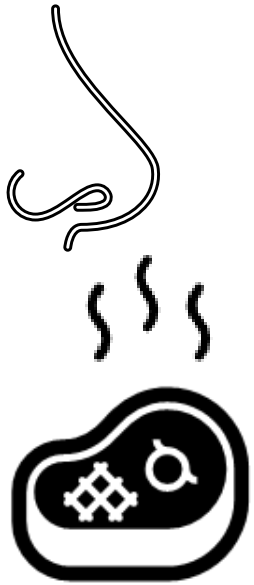


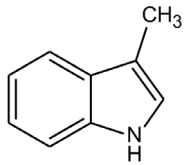


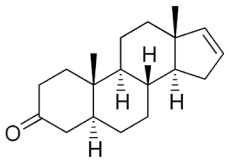
Font-i-Furnols et al., 2020

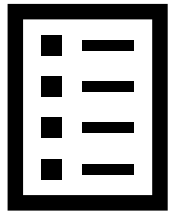
Introduction
Sensory evaluation



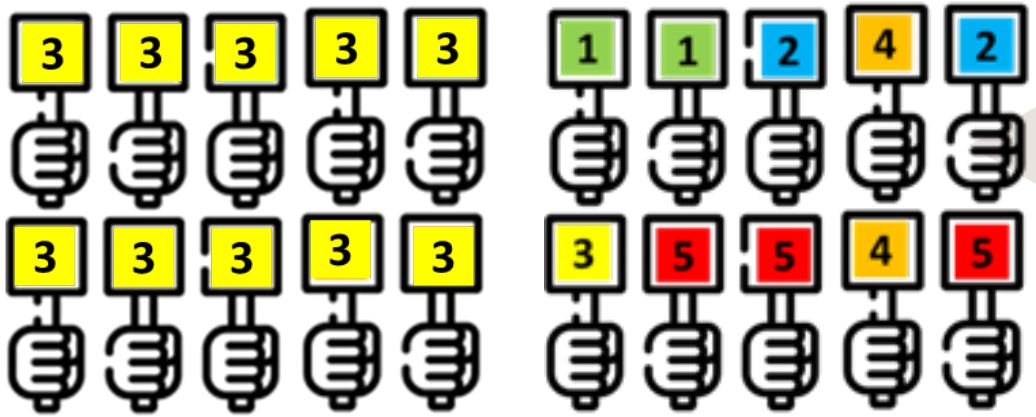




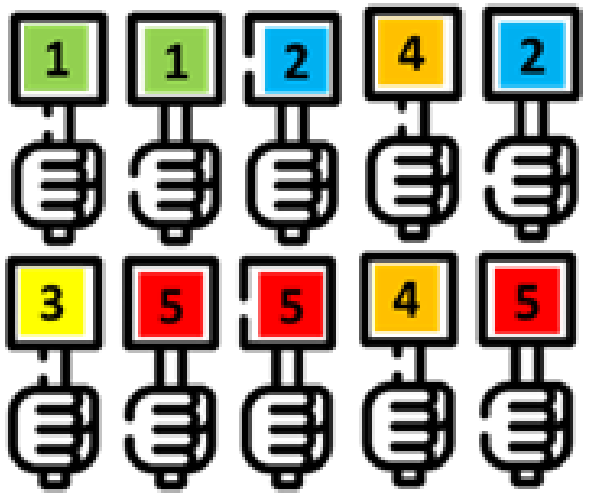


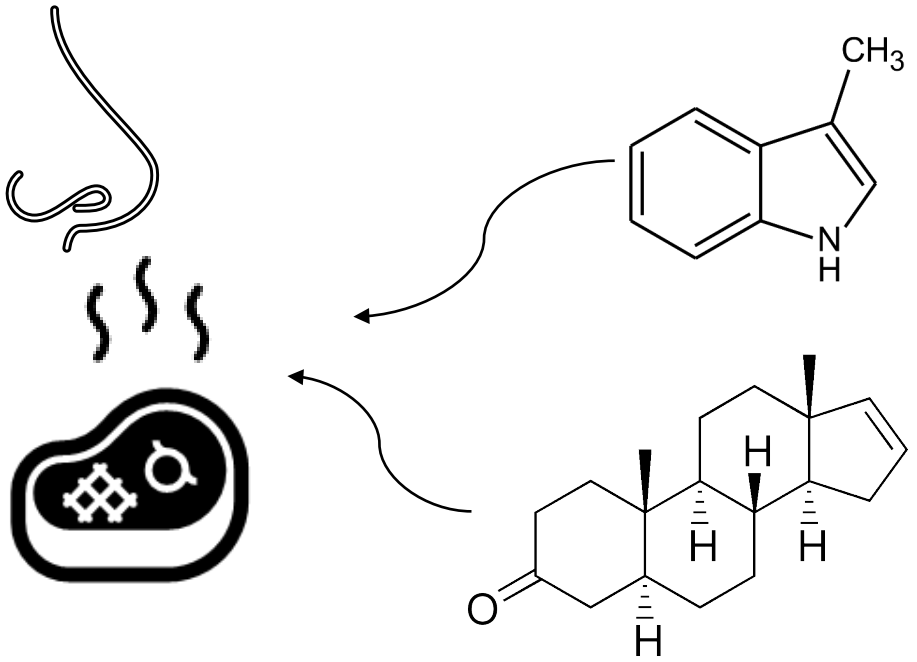


Expectation vs Reality

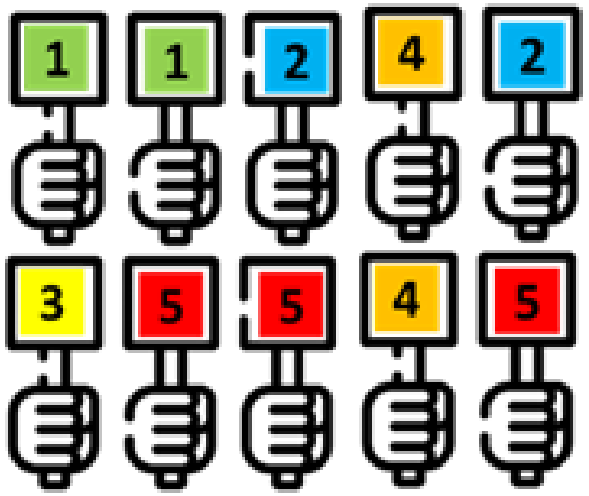


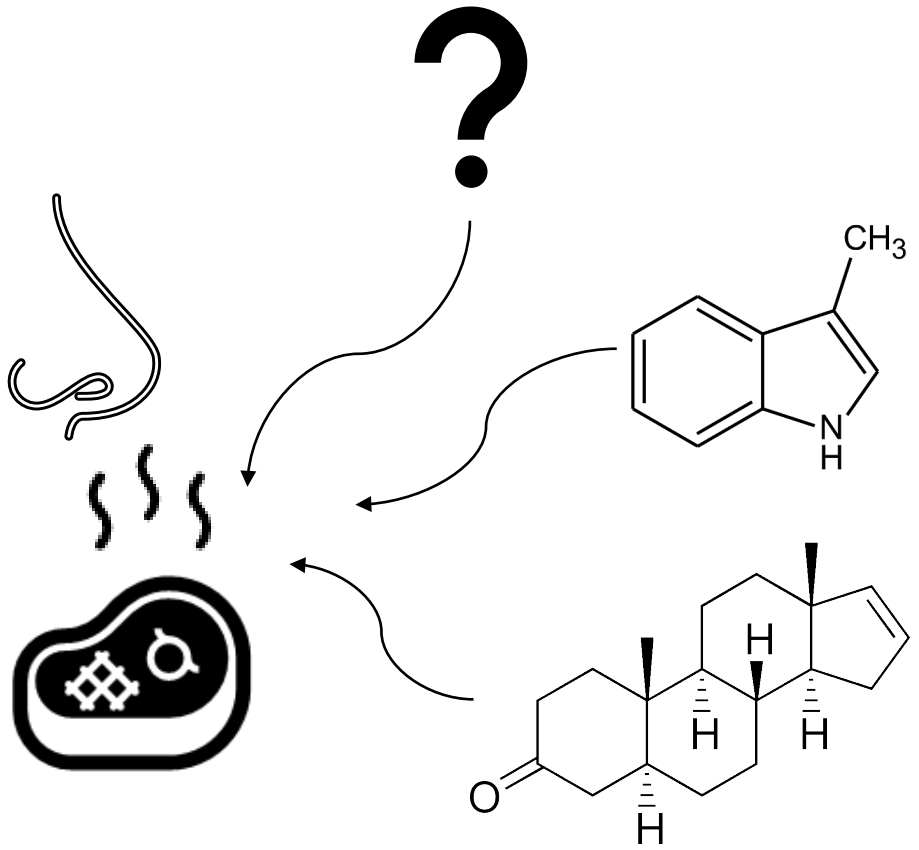
Introduction
Sensory evaluation



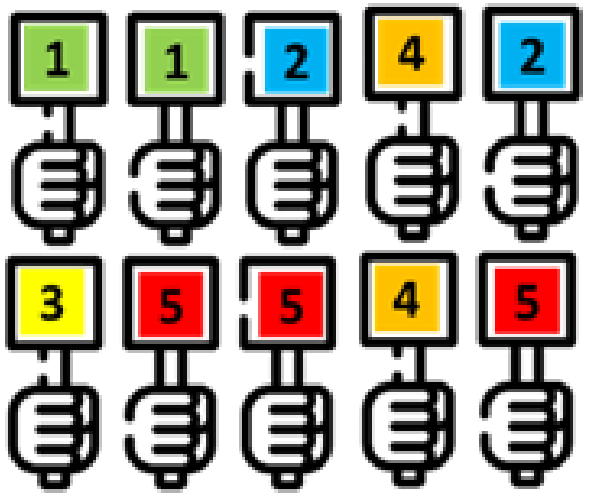


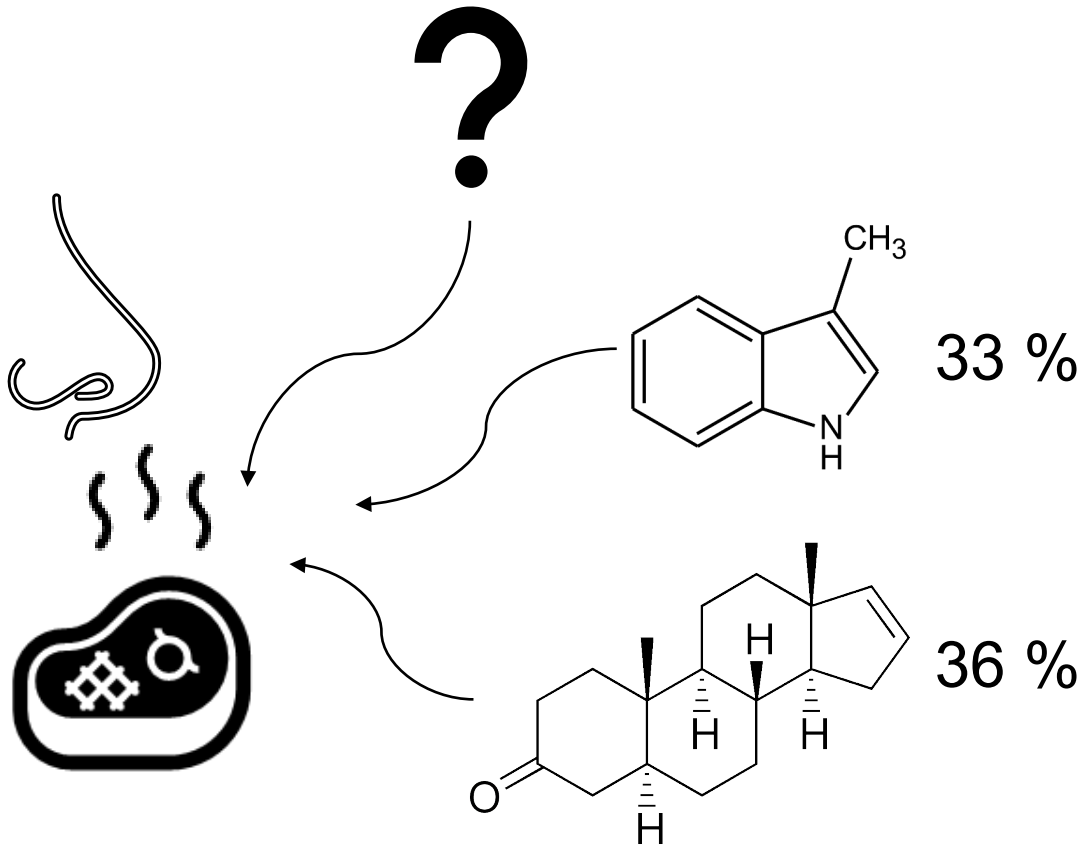
Introduction
Hypothesis





Introduction
Hypothesis





Hansson et al., 1980

Objectives

- To characterize the origin of olfactory deviant attribution compared to skatole and androstenone concentrations

Objectives

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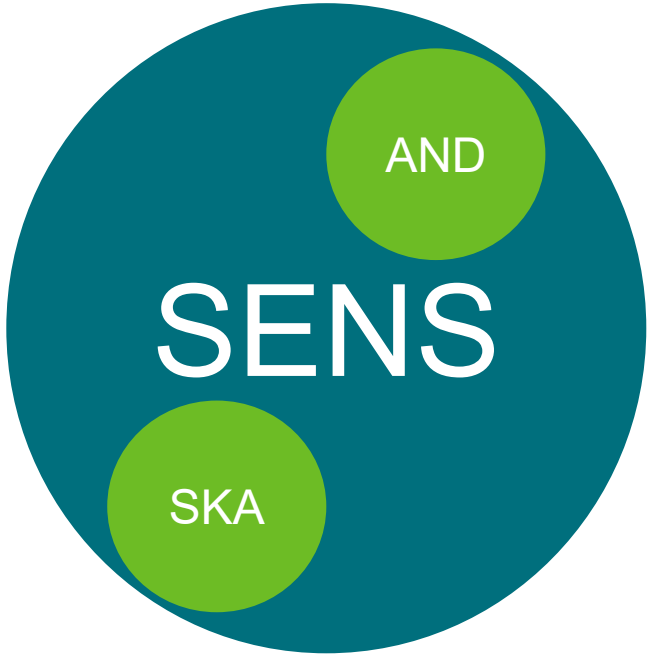
HOW?

→SKA and AND are causal traits

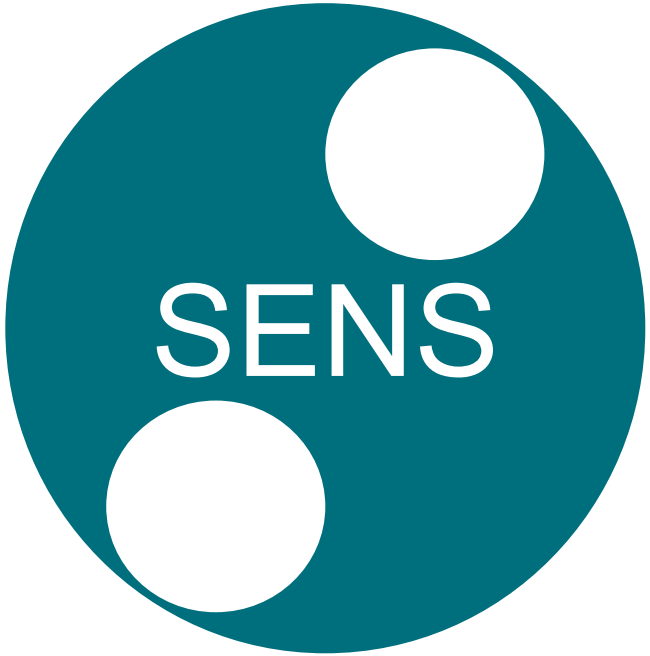


Objectives

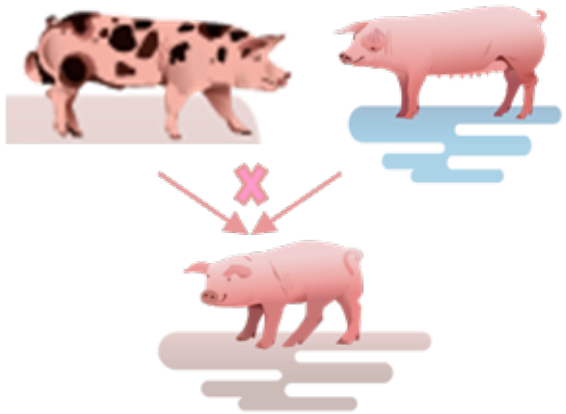
- To characterize the origin of olfactory deviant attribution compared to skatole and androstenone concentrations

HOW?

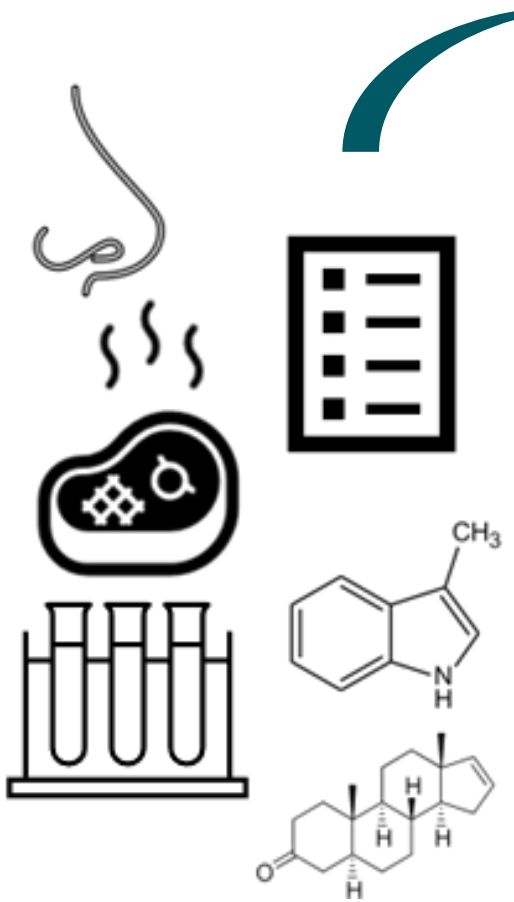
→SKA and AND constant by retiring causal environment

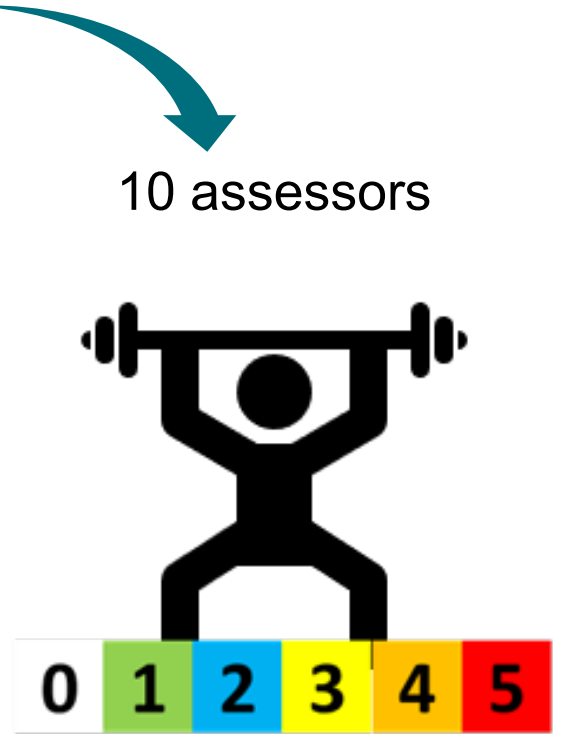


Material and methods



1016 crossbred ♂
PixF1





Mörlein et al., 2016

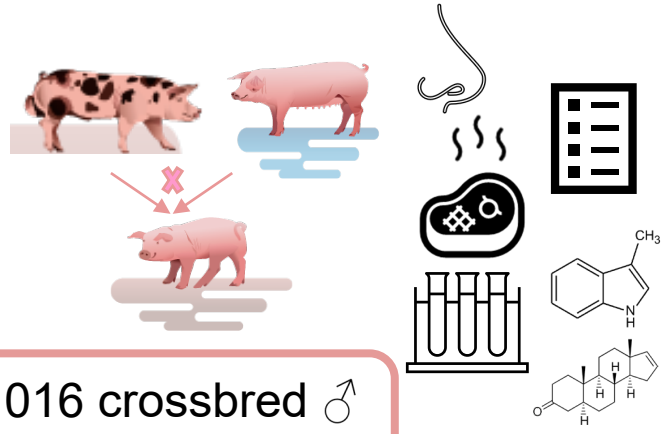
Quantification by
SIDA-HS-SPME-GC-MS

Material and methods

Multivariate model (MM)

REML associated to BLUP (BLUPF90+)

$$\mathbf{y} = \mathbf{Xb} + \mathbf{Zu} + \mathbf{e}$$



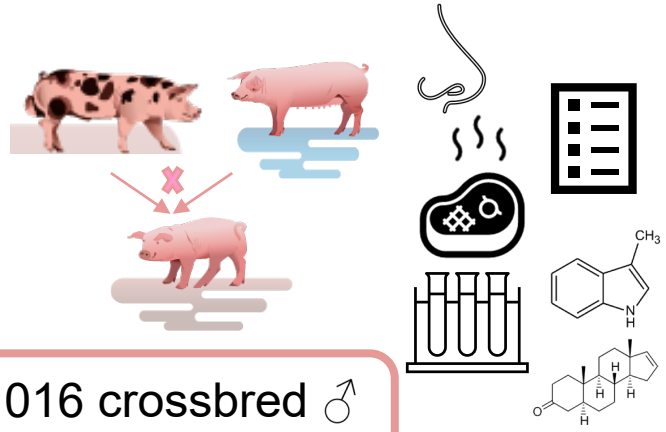
1016 crossbred ♂
PixF1

y	- log(SKA) & log(AND) & SENS1-SENS10 (n=1016)
Xb	- fixed environmental contributions (slaughter month×testing station) &
	- regressions on slaughterweight and age
Zu	- random genetic (animal) contributions (n=1934)
e	- residual

$\mathbf{u} \sim N(\mathbf{0}, \mathbf{A} \otimes \mathbf{G})$ and $\mathbf{e} \sim N(\mathbf{0}, \mathbf{I} \otimes \mathbf{R})$

Material and methods

Recursive model (RM)



1016 crossbred ♂
PixF1

REML associated to BLUP (BLUPF90+)

$$\mathbf{y = Xb + Zu + e}$$

y	- log(SKA) & log(AND) & SENS1-SENS10 (n=1016)
Xb	- fixed environmental contributions (slaughter month×testing station) &
	- regressions on slaughterweight and age
Zu	- random genetic (animal) contributions (n=1934)
e*	- residual

$$\mathbf{u} \sim N(\mathbf{0}, \mathbf{A} \otimes \mathbf{G}) \text{ and } \mathbf{e} \sim N(\mathbf{0}, \mathbf{I} \otimes \mathbf{R})$$

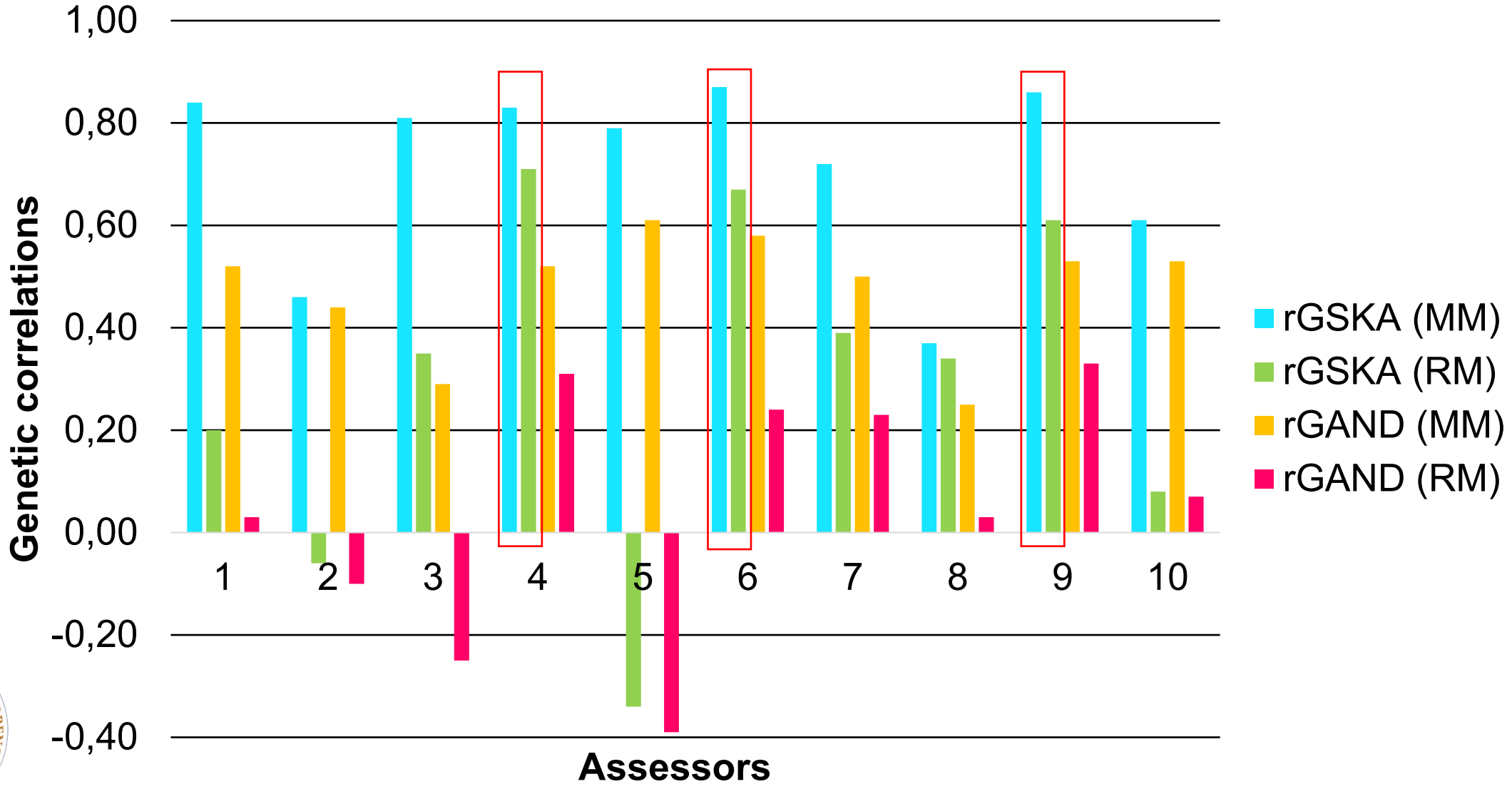
$\mathbf{R_{RM}} = \mathbf{\Lambda R \Lambda'}$ $\mathbf{G_{RM}} = \mathbf{\Lambda G \Lambda'}$ where $\mathbf{\Lambda}$ is a 12x12 matrix of recursive model parameters

Varona et al., 2023

Results

Assessor	h^2 (MM)	h^2 (RM)	$\Delta \sigma_u^2$
1	0.11	0.04	71.08 %
2	0.17	0.14	27.07 %
3	0.07	0.04	48.97 %
4	0.25	0.16	43.64 %
5	0.11	0.05	62.21 %
6	0.07	0.02	64.57 %
7	0.30	0.19	46.89 %
8	0.08	0.08	1.19 %
9	0.23	0.11	62.30 %
10	0.11	0.07	45.14 %

Results


1,00
0,80
0,60
0,40
0,20
0,00
-0,20
-0,40
Genetic correlations
1
2
3
4
5
6
7
8
9
10
Assessors
rGSKA (MM)
rGSKA (RM)
rGAND (MM)
rGAND (RM)

Results

Assessor

Assessor	1	2	3	4	5	6	7	8	9	10
1		0.30	-0.12	0.10	-0.42	-0.09	0.07	-0.17	0.18	-0.17
2	0.21		0.47	-0.16	0.23	0.27	-0.04	0.18	0.19	0.35
3	0.11	0.13		0.49	0.20	0.37	-0.03	0.31	0.37	0.35
4	0.13	0.19	0.08		-0.38	0.16	0.18	0.03	0.61	0.06
5	0.13	0.15	0.06	0.09		0.18	-0.08	-0.27	0.12	-0.25
6	0.14	0.14	0.07	0.17	0.08		0.50	0.54	0.45	0.31
7	0.18	0.13	0.04	0.23	0.14	0.14		0.40	0.53	0.40
8	0.03	0.03	0.04	0.07	0.03	0.01	0.11		-0.16	0.83
9	0.04	0.06	-0.04	0.08	0.04	0.08	0.13	0.01		-0.08
10	0.18	0.25	0.11	0.13	0.13	0.11	0.11	0.03	0.06	

Genetic correlations

Phenotypic correlations

Conclusions

- SENS have moderate heritabilities.
- Other heritable compounds influence SENS assignement.
- SENS evaluation is associated with correlated compounds to SKA or AND too.
- Common relationships between the assessors assignement exist by genetically correlated compounds that are neither skatole, nor androstenone.

Thank you for your attention !

alice.markey@uliege.be