Going past the threshold requires nerve: problems and solutions to testing and odour evaluation

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Threshold testing

- Used as a method to train and test odour panelists for a variety of procedures; dynamic olfactometry, odour identification, GC-MS/O

- Represents the basis of Odour Units; OU is calculated as the number of dilutions required for an odour sample to be at a threshold value by 50% of panellists

- Has a lot of inter-laboratory variability despite being common practice- why?

Challenges with threshold testing

- Threshold testing is by its nature “exhibits maximum susceptibility to contaminating influences” (Cain 1980) which can include:
  - humidity variation
  - temperature variation
  - disposition of panellist
  - familiarity with testing procedure
  - what the panellist experienced on their walk to the testing facility
  - what is the “dominant nostril” at time of testing
  - many more known and unknown variables

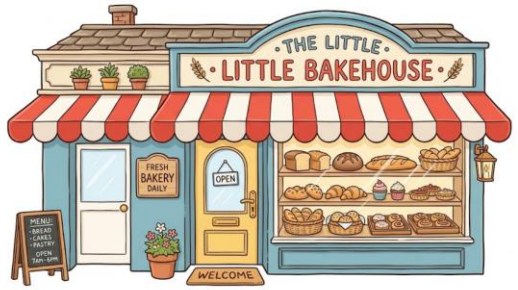
- Can miss pertinent anosmias

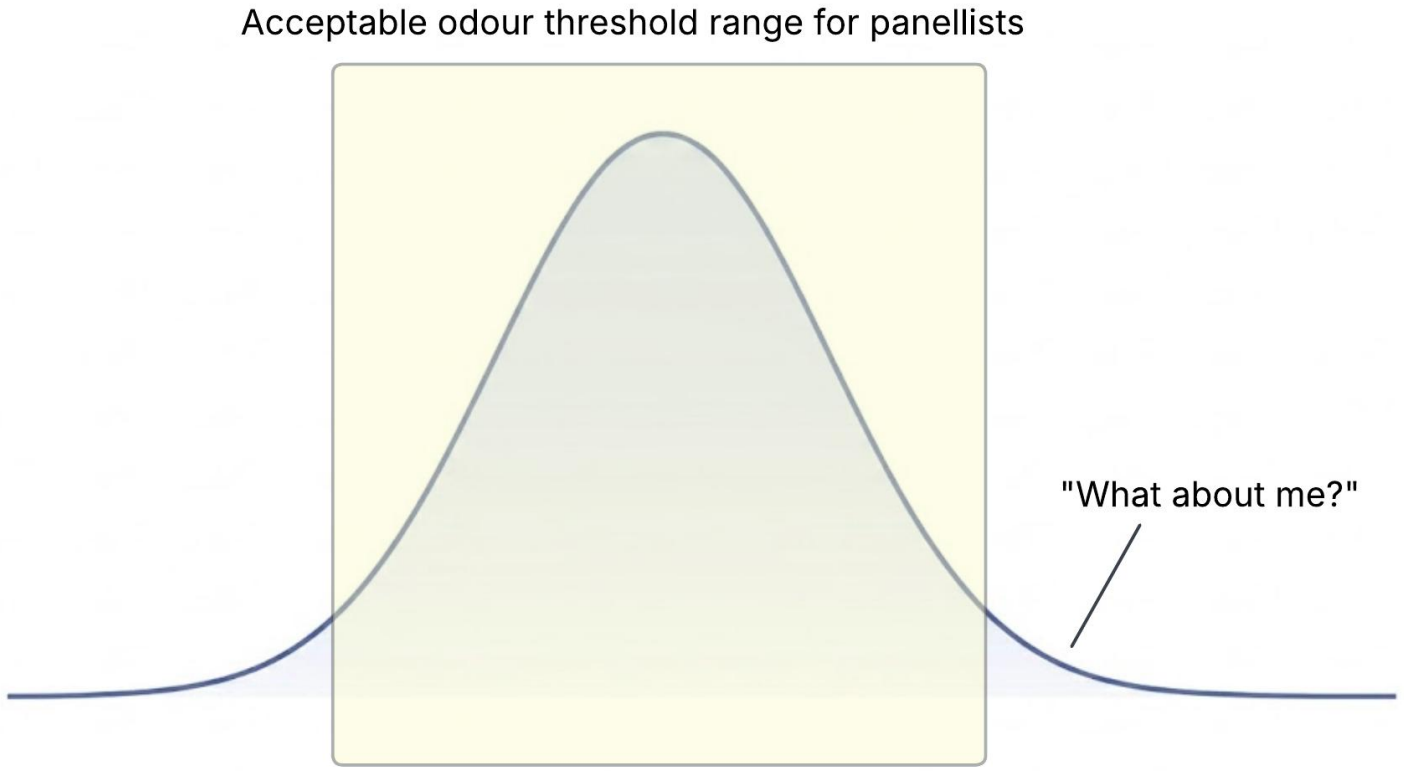
Challenges to ou testing

- Not representative of FIDOL attributes (but can be implemented later)
- Based on concentration measurement, which has varied correlation with intensity and offensiveness (the relationships are being better understood)
- Accuracy can be misinterpreted by non-experts

7 ou= acceptable

8 ou= unacceptable





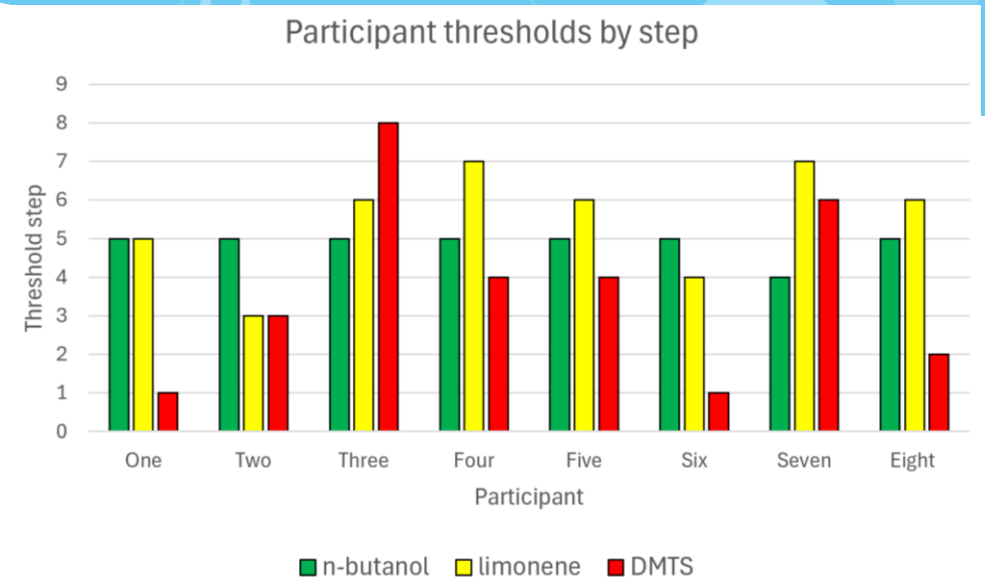
How and why do we use n-butanol?

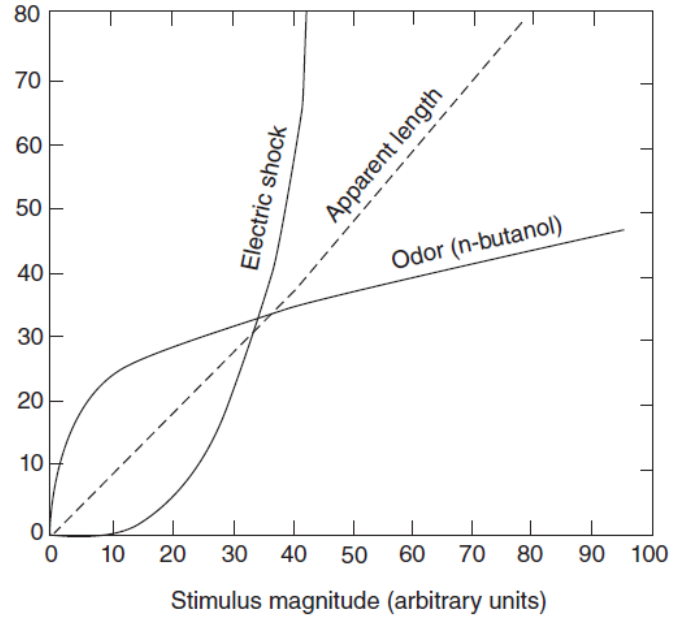
Used to train and test olfactory panelists, particularly for threshold testing (in every domain)

- Readily available
- Neutral odour
- Transferable to environmental odour assessments
- Predictable dose-response relationship
- Extensively researched compared to most odorants

Challenges of using *n*-butanol

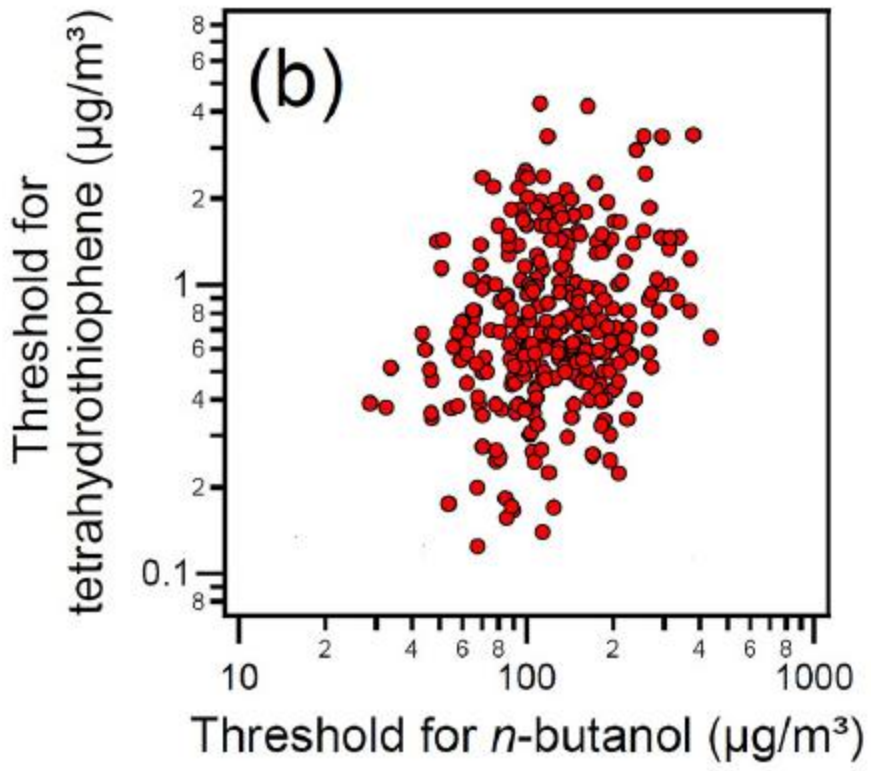
- Not representative of other environmental odours
- Dose-response intensity relationship skews (but better than most)
- Affects the trigeminal nerve
- Test-retest reliability coefficient of *n*-butanol hovers around r=0.50 (Doty *et al*. 1995)



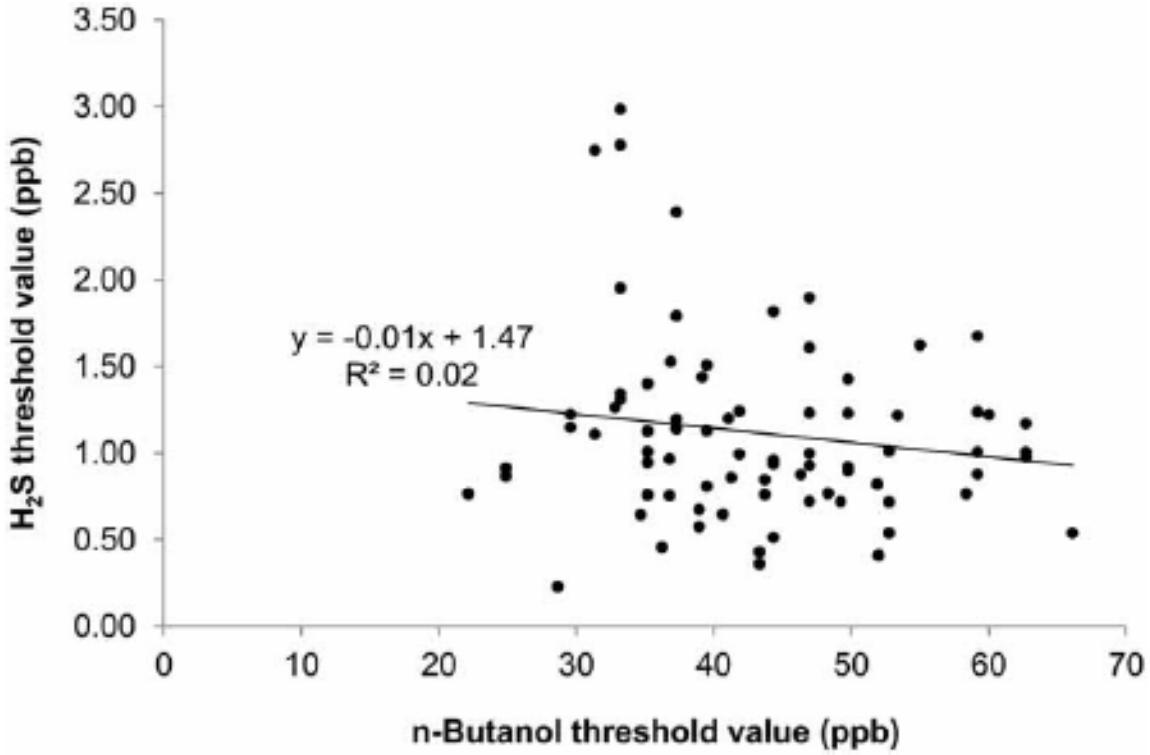


Doty & Laing (2015)

Comparisons between *n*-butanol and other odorants

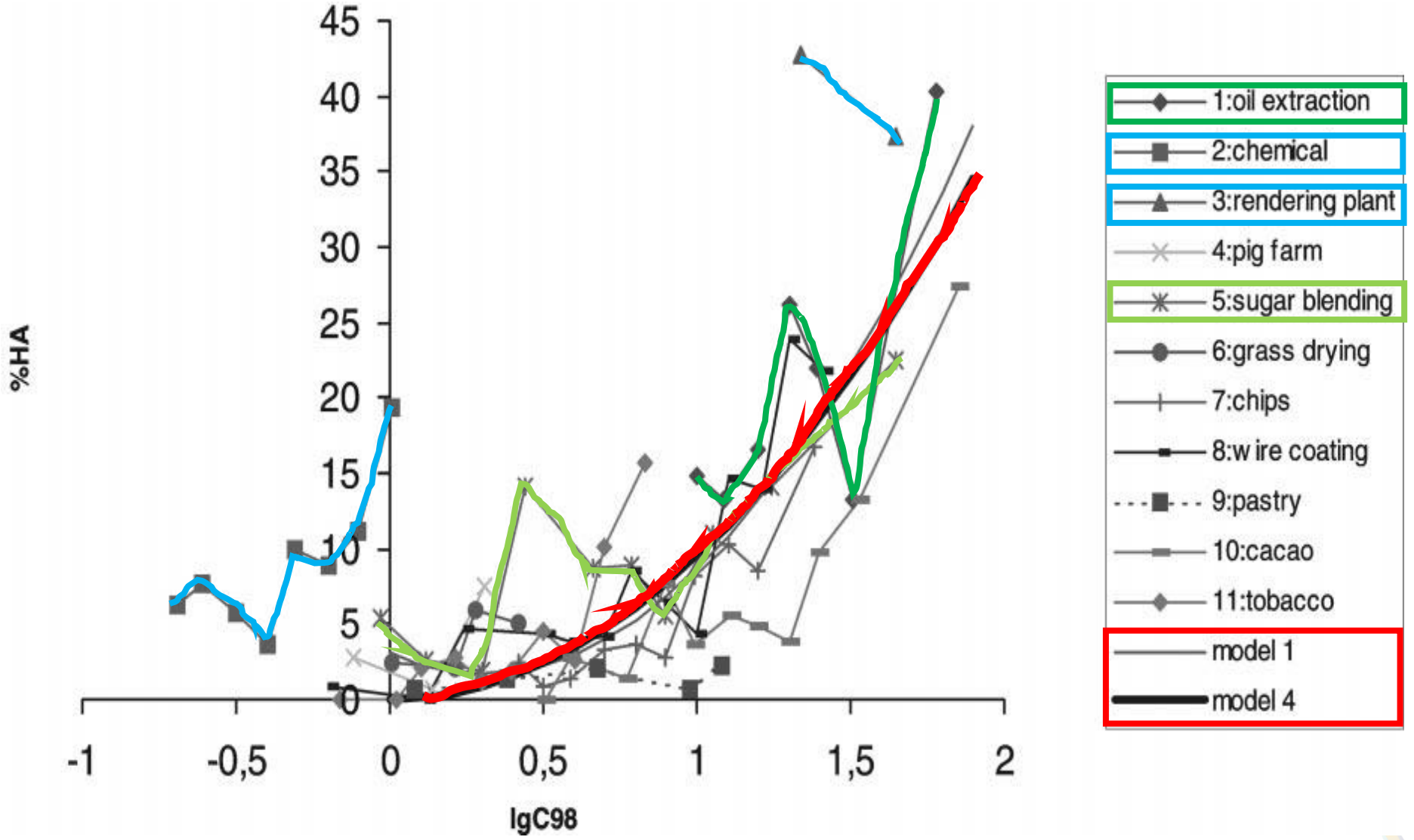


Antonsson *et al*. (2024)



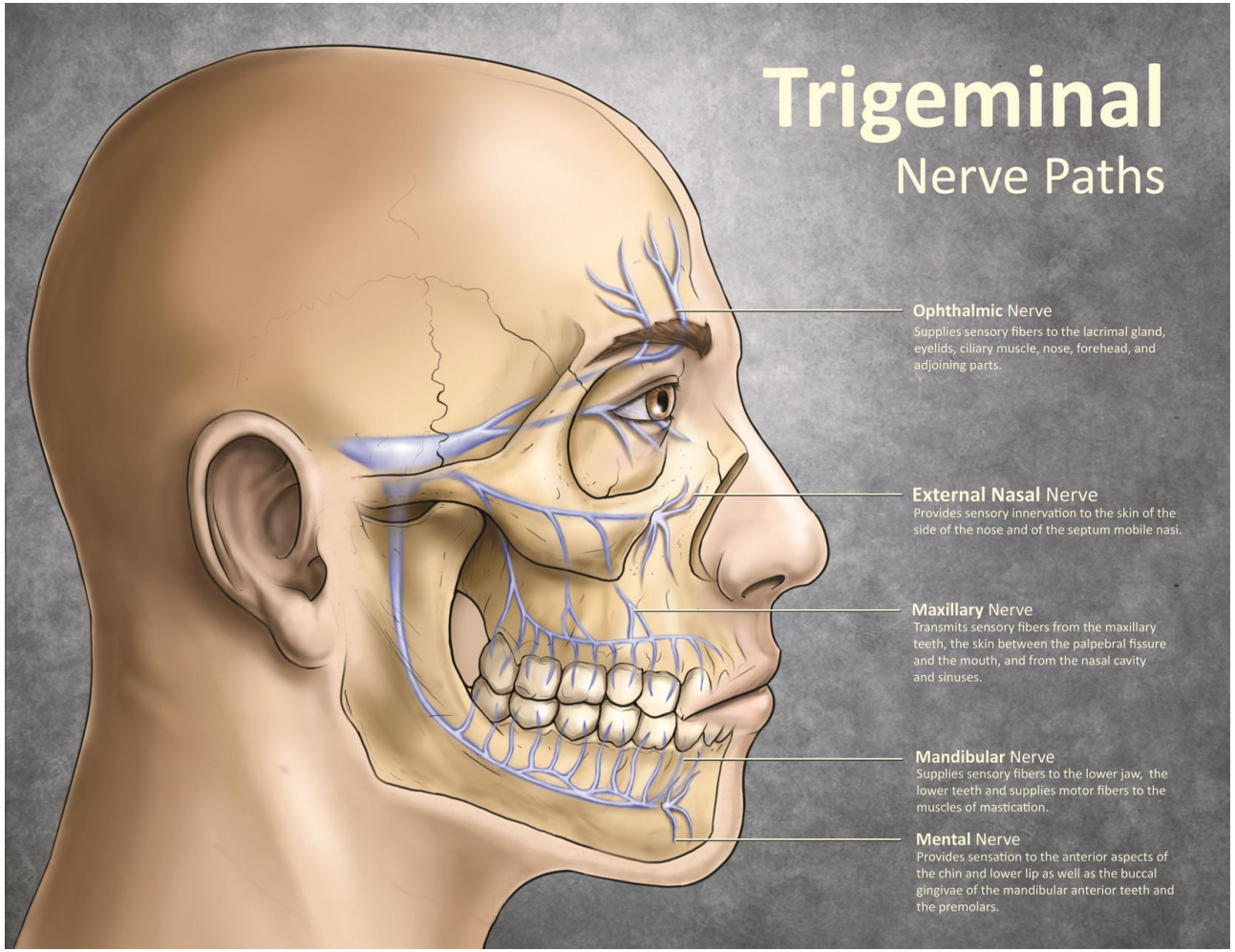
Feilberg *et al*. (2018)

All odorants have varying dose response relationships



Miedema et al. 2000

The trigeminal nerve

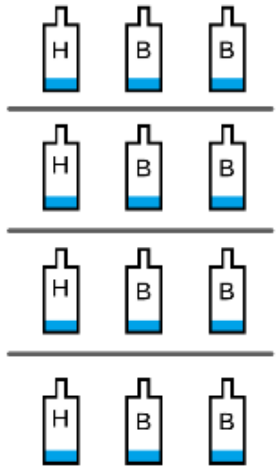


https://www.scmp.com/lifestyle/health-wellness/article/2164970/what-cluster-headache-first-person-account-most-painful

- Related, but independent of olfaction
- Many odours cause varying degrees of trigeminal nerve activation
- Modulated by lifestyle and culture
- Most likely responsible for a lot of discrepancies in community reaction
- Responsible for a number of very powerful involuntary actions in the body including sneezing, tingling, numbing, and migraines

Olfactory Discrimination as a complement

- Test panellists to identify pertinent odour samples at a low suprathreshold value against two blanks in 4 sets.
- Greatly reduces anosmia risk
- Provides ecological validity as it is based on *intensity*
- Easy, fast, and inexpensive to administer
- Data is quantifiable in a way similar to threshold testing
- Other tests like the VDI 3882.1 also act as a quantifiable measure of intensity



4 correct hits = $\frac{1}{3 \times 3 \times 3 \times 3}$ = 1/81, p= 0.01

3 correct hits = $\frac{1}{3 \times 3 \times 3}$ = 1/27, p= 0.03

2 correct hits = $\frac{1}{3 \times 3}$ = 1/27, p= 0.1

Incorporating trigeminal nerve activation into assessment

- Identify compounds and likely compounds (sulfur dioxide, ammonia, nicotine, alcohols, formaldehyde, ozone)
- Include in odour wheels descriptors such as “nose feel”
- Include trigeminal nerve activation symptoms into odour field assessment

Summary

- Threshold testing, ou, and *n*-butanol all have important uses but we should acknowledge what these measures are capable of

- Olfactory Discrimination tests offer a way to complement panellist assessment

- The trigeminal nerve is likely a confounding variable for odour testing and community exposure, but can be included in assessments

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Thank you