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New methodologies to help odorisation

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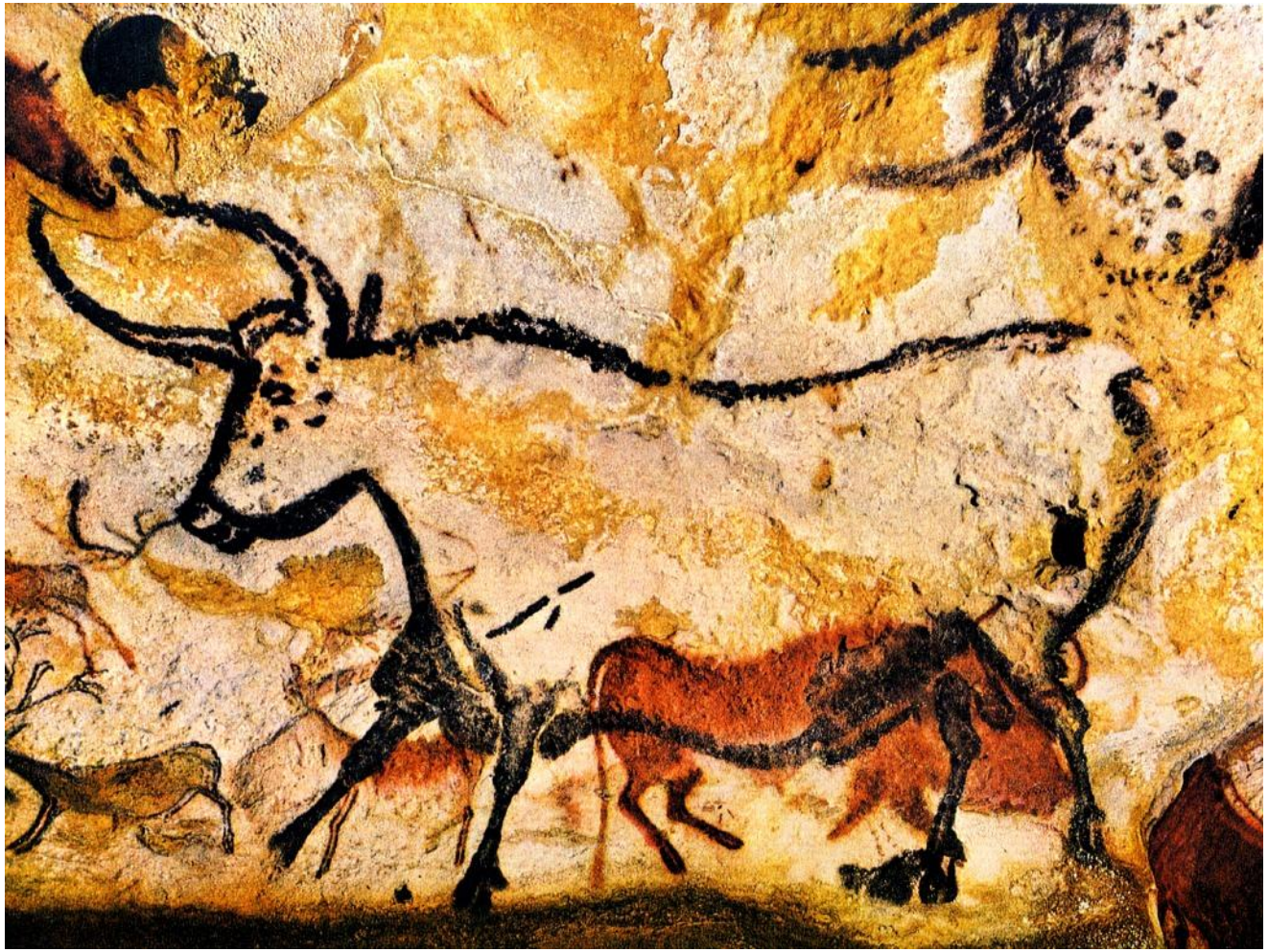
Gas odorisation in a few words

- A legal requirement in all countries
  - Distributed gas shall smell (before its concentration reaches 20% LEL)
  - The smell shall be characteristic
- How is it done?
  - Use of THT or TBM based odorants (60 years experience)
  - Injection rate roughly similar everywhere
    - 15 to 30 mg/m^3 for THT
    - 5 to 10 mg/m^3 for TBM including blends
  - Evolution based on *"not broken don't fix it!"* principle.
- But there are still some open questions
  - How can I change odorant?
  - How can I demonstrate that legal requirement is fulfilled?
- With a common answer: **Smell it!**

20 000 years ago: A bull in a cave

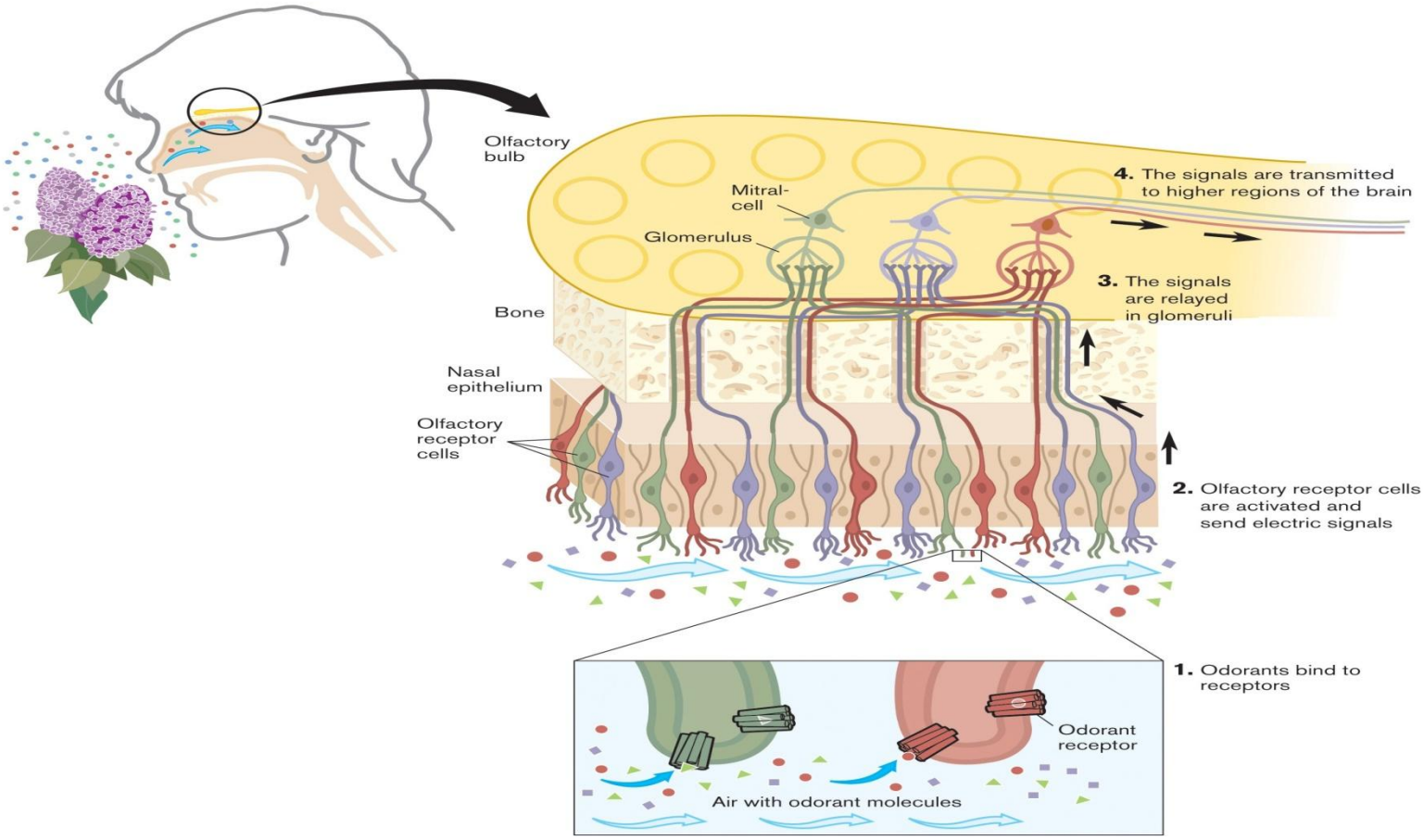


600 years ago: The Galilean moons

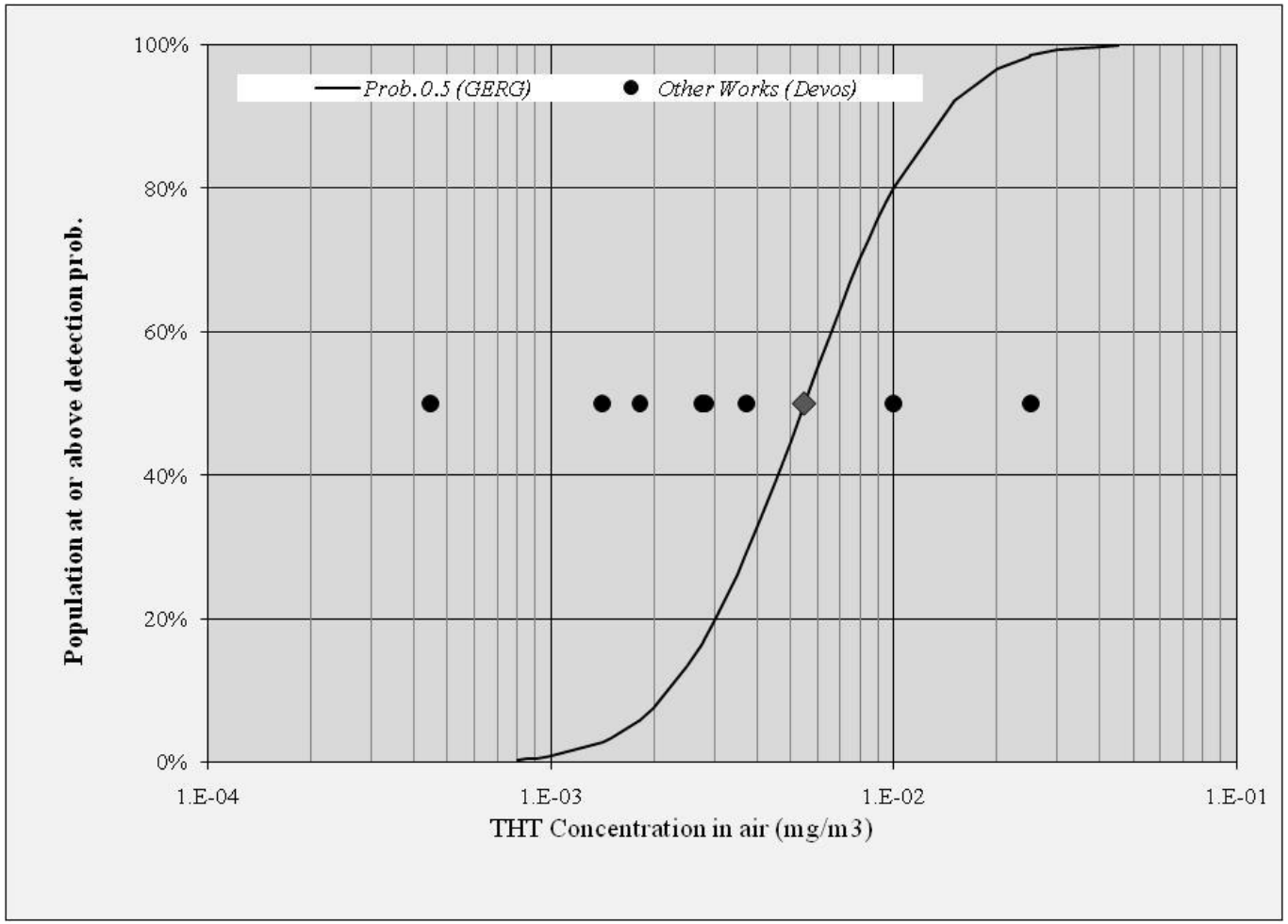
20 years ago: major discovery on olfaction

- The Nobel Prize in Physiology or Medicine 2004 was awarded jointly to Richard Axel and Linda B. Buck *"for their discoveries of odorant receptors and the organization of the olfactory system"*

This is what we know about smell



Sensorial analysis: "Methodology impact results!"



More difficult: How strong does it smell?

➢ Example: Results of RR test for Jury selection

- **Samples to be classified for jury selection**

Sample	THT Concentration in air (µg/m³ - *ppb*)
S 1	45 - *11*
S 2	126 - *32*
S 3	289 - *73*

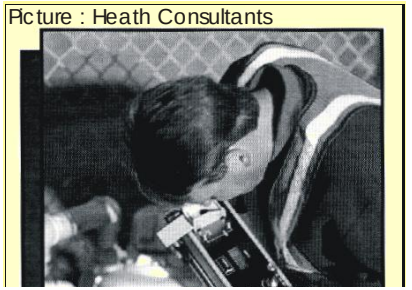
- **Results obtained**

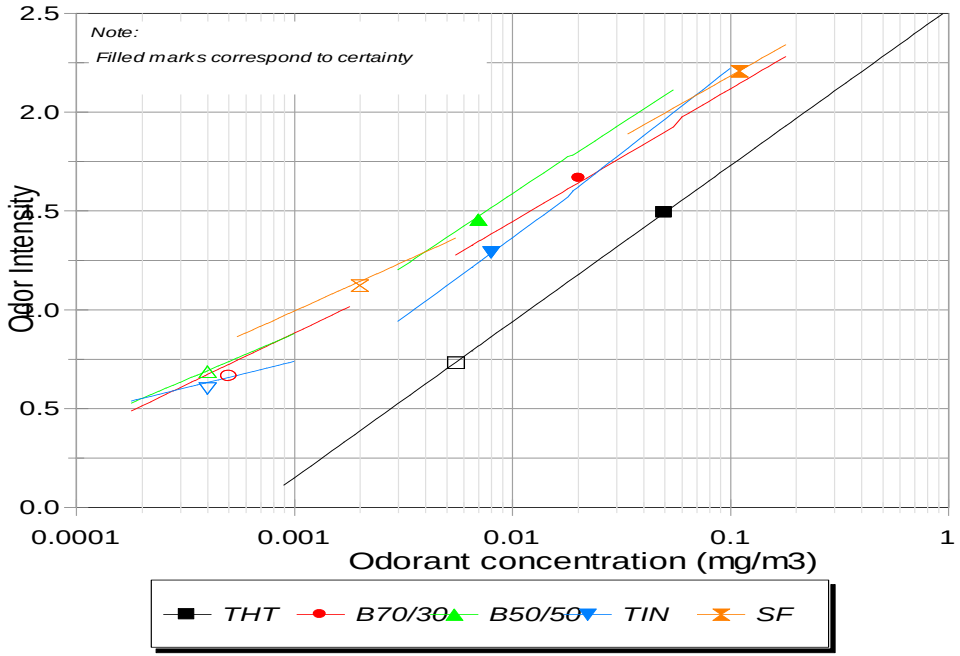
Panelist answers	Lab 1			Lab 2			Lab 3			Lab 4			Lab 5			Correct answer
	1A	1B	1C	2A	2B	2C	3A	3B	3C	4A	4B	4C	5A	5B	5C	
Lowest	S1	S 2	S 2	S1	S1	S1	S 2	S1	S1	S1	S1	S1	S1	S1	S1	S1
Middle	S 3	S1	S1	S 2	S 2	S 2	S1	S 3	S 3	S 2	S 2	S 2	S 2	S 3	S 2	S 2
Highest	S 2	S 3	S 3	S 3	S 3	S 3	S 3	S 2	S 2	S 3	S 3	S 3	S 3	S 2	S 3	S 3

➢ Training (calibration) of panelists helps!

Checking that the odour is detectable

- **ASTM: Is smell sufficient?**
  - Reference and training not described
  - Results difficult to interpret
- **UNI: Drawing odour intensity curves**
  - Several "sniffers"
  - Trained (calibrated) against a reference
  - Enables to compare different set of odour int
  - One don't know if the odour is sufficient
- **VDI: Is the smell strong?**
  - Various concentration of odorant
  - Concentration "strong" for at least 84 % of p
  - What does strong mean?





GERG agrees on a methodology → ISO standard?

- **Widely inspired by UNI Standard**
  - Evaluation conducted by a panel of four people.
  - Panelists are trained against THT as a reference.
  - Methods to evaluate uncertainty is presented.
  - Key elements (presentation mode, etc.) defined.
- **Advantages**
  - Odour intensity curves obtained in reproducible way
  - Uncertainties assessed
  - Enables comparison of odorants – Comparison of results between laboratories
- **Shortcoming**
  - No answer to "How much shall I inject to raise an alarm before 20%LEL?"
  - But one can compares with current practice.

What about characteristic smell?

- **Gas smell shall be different to usual smell but**
  - What is a gas smell? What is different?
  - How people are discovering are learning the gas smell?
  - Is it possible to educate a population to a new gas smell?
- **How to answer**
  - Not too difficult if one stays with traditional odorants
    - Tokyo gas from TBM/DMS to TM/cyclohexane
  - Very hot topic if one goes to different products
    - Introduction of acrylates mixtures (Germany)
- **Tentative answer presented during IGRC 2011**
  - See poster 65 : "*The gas smell: a study of the public perception of gas odorants*"

To conclude

- The industry lacks harmonised methodology
  - Each company/country working on its own experience
  - Comparisons difficult
- Implement harmonised methods for odour intensity measurement
  - Achievable on short term basis
  - Would allow to improve and share knowledge of different odorants
- Develop methods to qualify the "characteristic" gas smell
  - It is a challenge but some roadmap can be drawn
    - Agree on a simple methodology for checking the evocation a smell
    - Test the association of different odours with gas: Are they cultural bias?
    - Expand from that base to assess "new" odour.
- Benefits
  - Quicker and easier qualification of new odorants
  - Access to a large and comprehensive data base to demonstrate the quality of odorisation