

Odorant receptors and the organization of the olfactory system

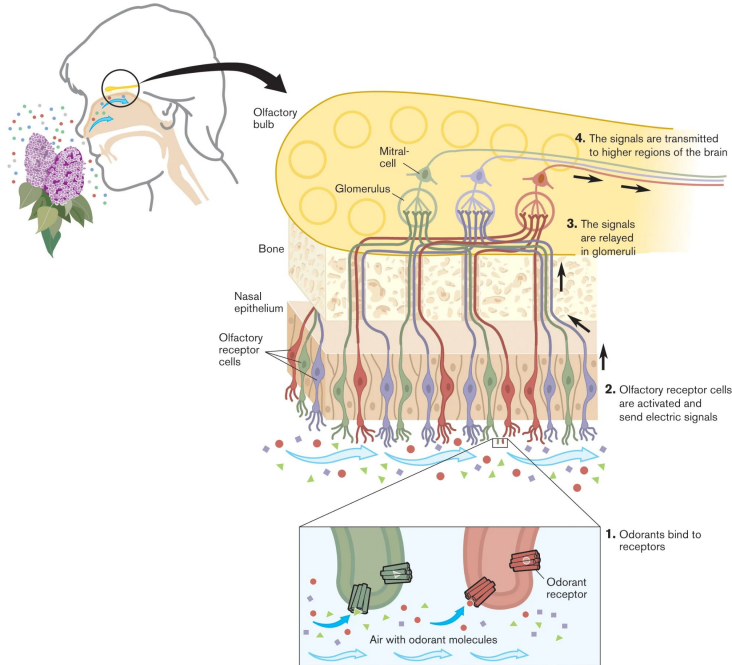
Bartosz Ziemba
Marcos Alvarez

Motivation

Why study the olfactory system?

- Principles for recognizing & remembering odours were not understood
- Odour can trigger memories.
- Of central importance for survival in most species.
- Some examples:
 - In fish, the olfactory system senses amino acids as odors.
 - Male silk moths use their olfactory system to detect female pheromones.

Odorant Receptors and the Organization of the Olfactory System

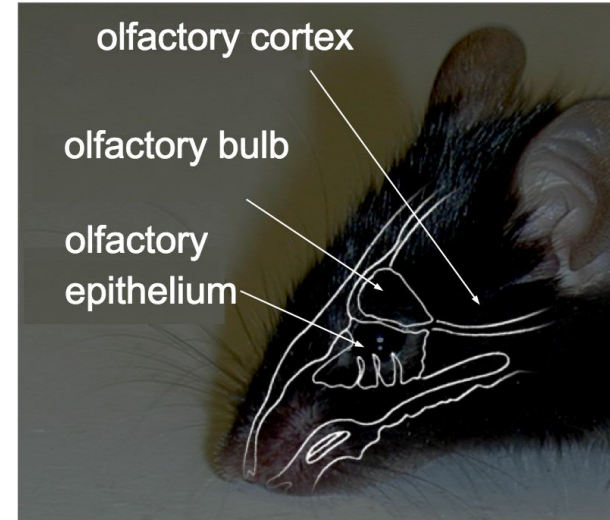


„A novel multigene family may encode odorant receptors: a molecular basis for odor recognition” - Buck & Axel, 1991

Buck & Axel wanted to test an idea of connecting a huge, previously unknown gene family with odor recognition

Experiment: procedure

1. Isolated mRNA from rat **olfactory epithelium** (only active genes)
2. **Degenerate primers** were added — sequences flexible enough to bind to **many similar genes**.
3. **PCR** was used to amplify cDNA fragments.
4. Used the fragments as probes in **expression tests**.



Adapted from <https://explore.psl.eu/en/discover/focus/mice-and-smells>

Experiment: results

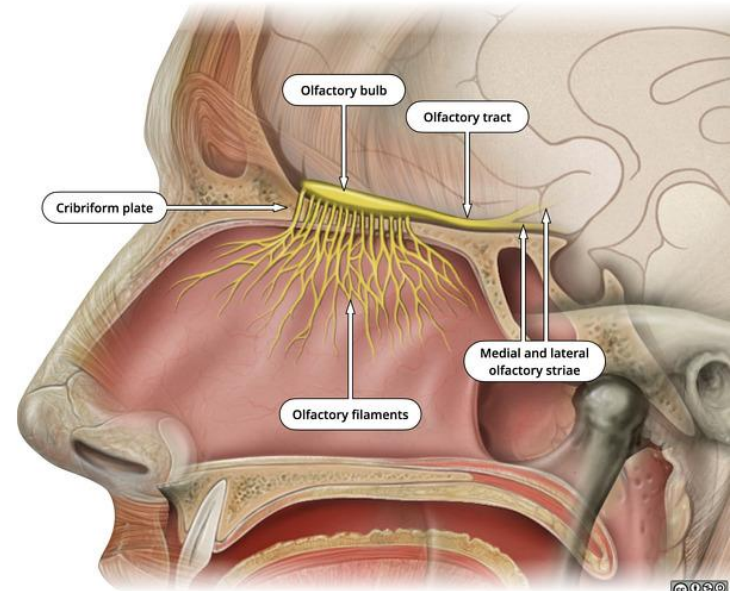
1. The PCR with primers reaction produced **many different DNA fragments**, all about the size expected for GPCR genes.
2. The extracted genes were expressed only in olfactory epithelium - sign of **specialised olfactory receptors**.
3. Genomic library screens revealed **100 to several hundred genes** in the family.

Implications/follow-up

- Smell uses the largest receptor repertoire of any sense.
- Each olfactory sensory neuron has only one type of the receptor gene.
- Each receptor can detect many different odors, and each odor can activate multiple receptors with varying intensity of response.
- This way different odorant stimuli can be processed uniquely - creating a **olfactory map**

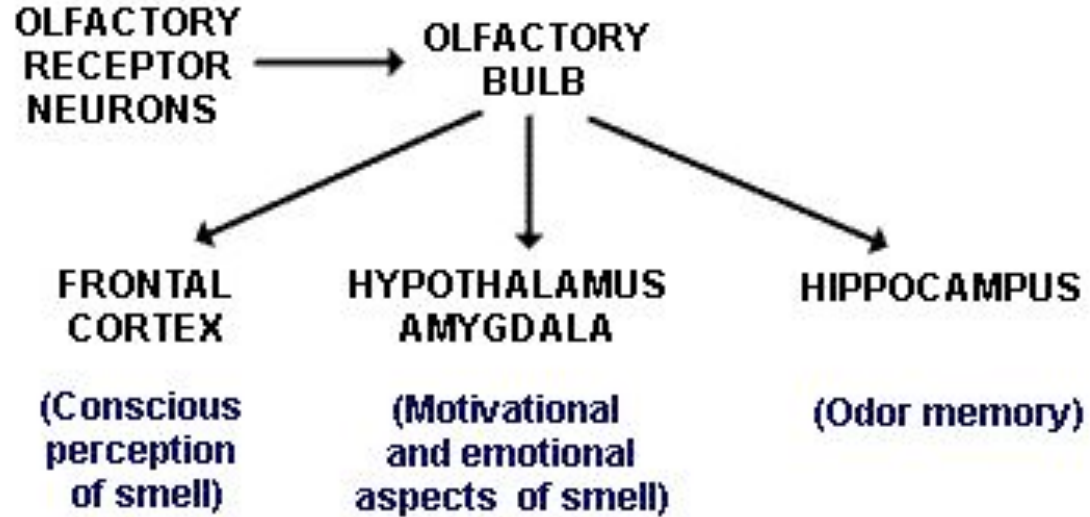
- Receptor cells with same receptor converge on same glomeruli in olfactory bulb.
- Creates a spatial map: different odors activate specific glomeruli patterns.
- Brain interprets these patterns to recognize and differentiate odors.

Olfactory nerve



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Adapted from <https://faculty.washington.edu/chudler/chems.html>

