The Sense of Smell

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26th April 2025

The Sense of Smell: Odour Perception and Flavour

Linda Buck & Richard Axel (who received the Nobel prize for Physiology in 2004) determined how the brain discriminates one odour from another.

They discovered a family of 1,000 olfactory receptor genes that give rise to an equivalent number of olfactory receptor types. They later found that closer to 350 of the receptor types may be active.

That number dwarfs the four types of receptors necessary for vision.

About 1 percent of human genes are devoted to olfaction. Only the immune system is comparable, which why smell is referred to as the our most enigmatic sense.

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Buck and Axel determined odour receptors operate in combination to encode odour identities.

Different odours are encoded by different combinations of odour receptors.

Each odour receptor is part of the code of many odours, and different odours have different receptor codes.

Altering the molecular structure of a chemical changes the receptor code and therefore the perceived odour.

A change in the concentration of an odour may change how it is perceived. Higher concentrations involve additional odour receptors, again altering the odour response.

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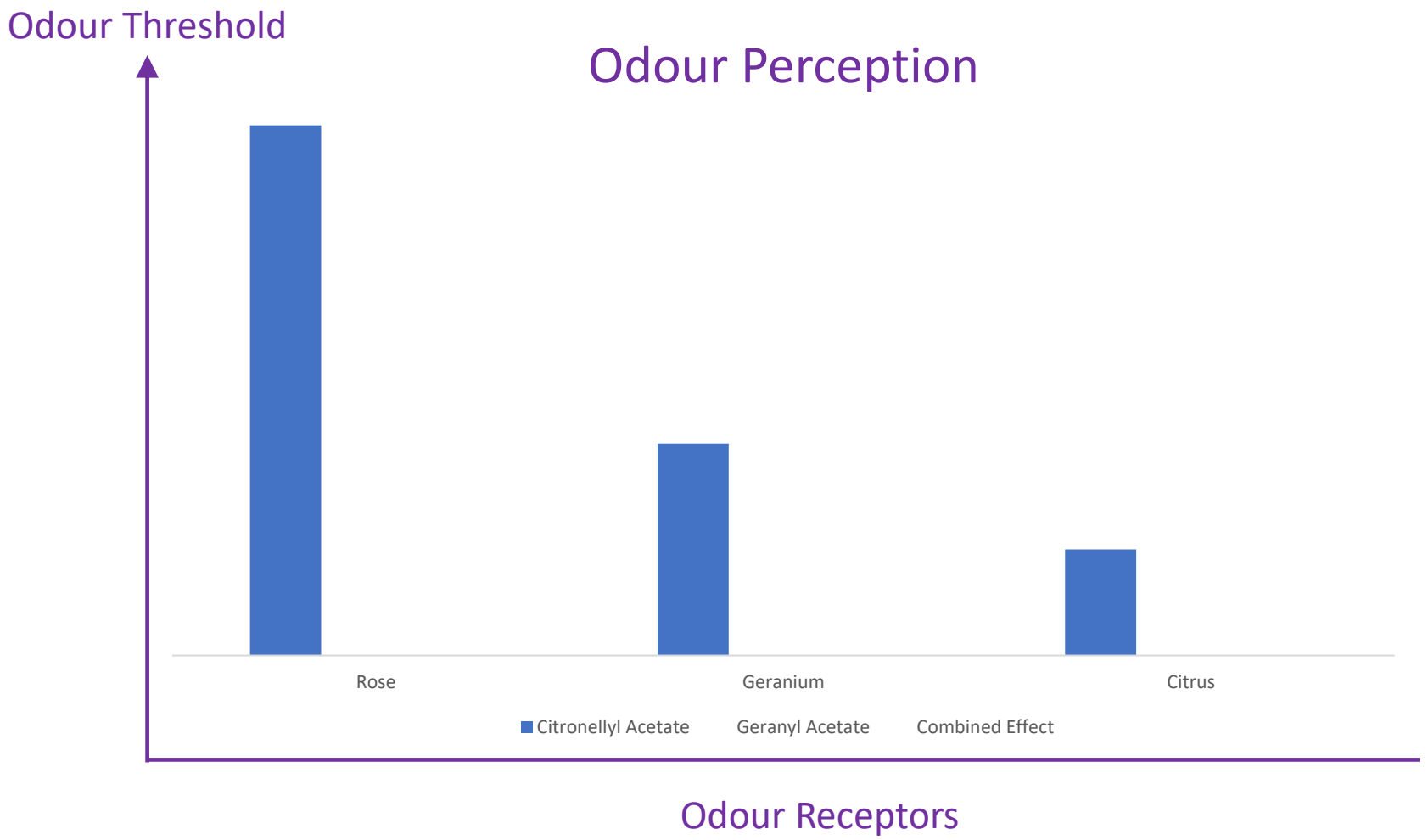

Citronellyl Acetate:
Rose, Geranium, Citrus

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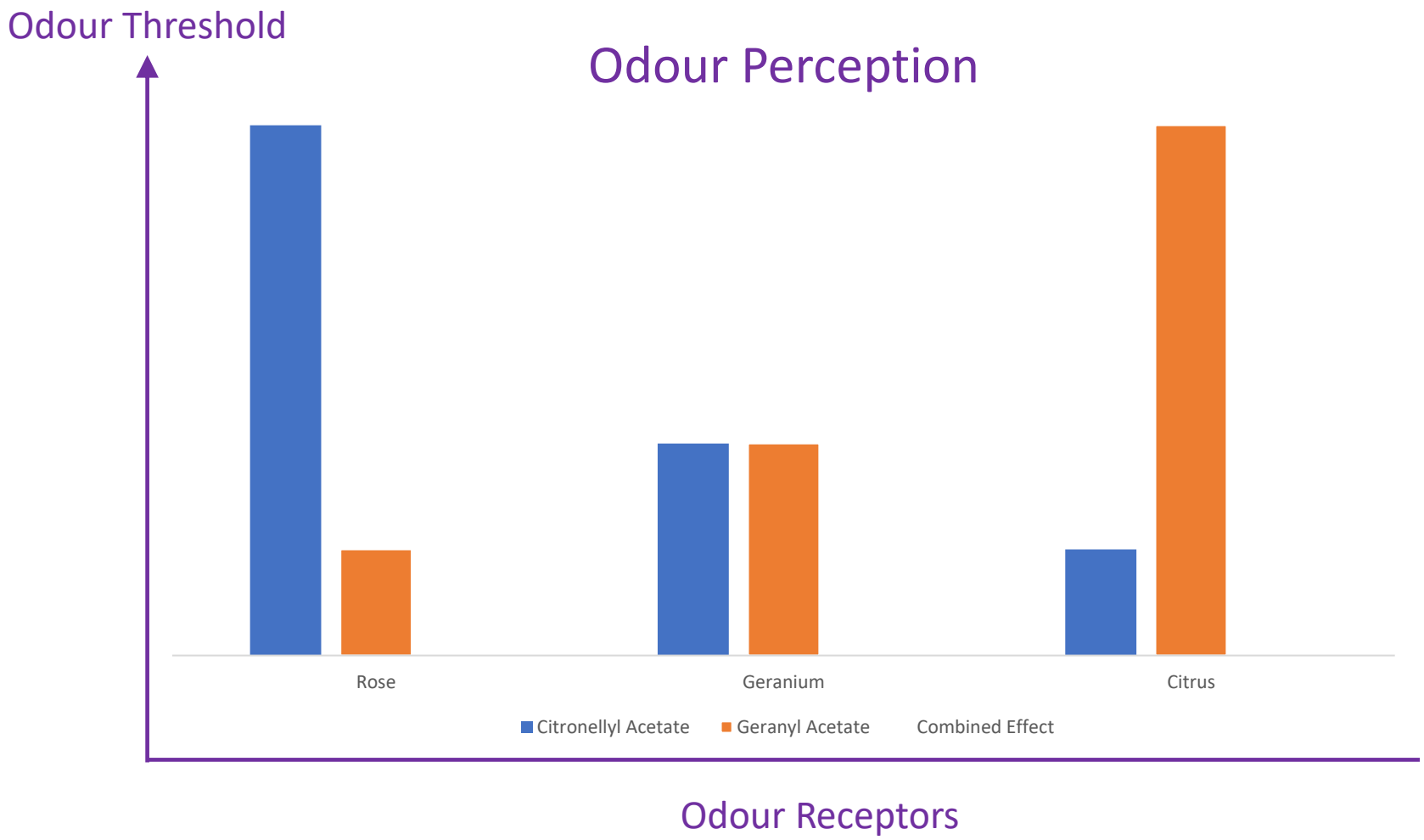

Citronellyl Acetate:
Rose, Geranium, Citrus

Geranyl Acetate:
Citrus, Rose, Geranium

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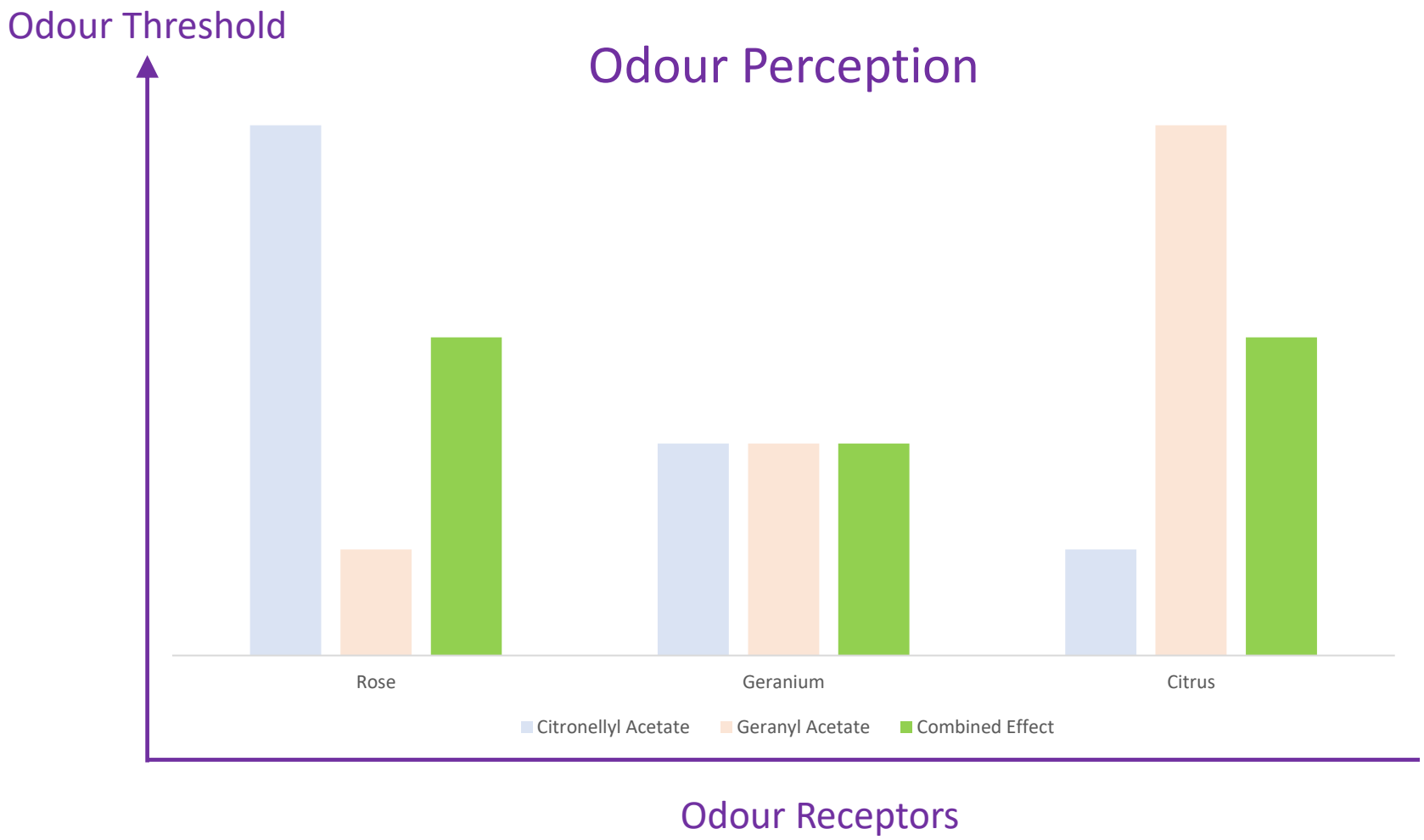

Citronellyl Acetate:
Rose, Geranium, Citrus

Geranyl Acetate:
Citrus, Rose, Geranium

Combined:
Rose, Geranium, Citrus

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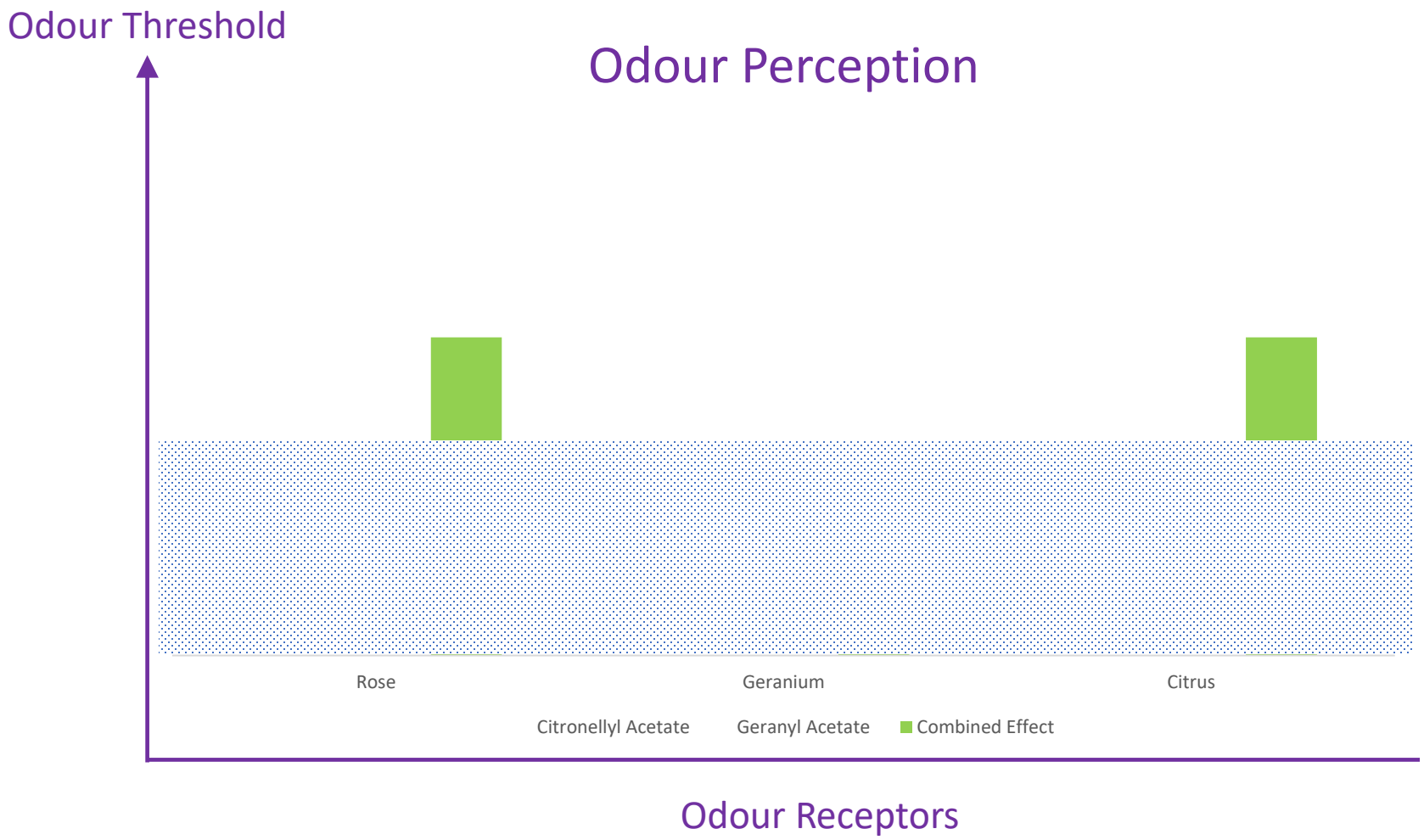

Citronellyl Acetate:
Rose, Geranium, Citrus

Geranyl Acetate:
Citrus, Rose, Geranium

Combined:
Rose, Geranium, Citrus

Combined @ lower conc:
Rose, Geranium

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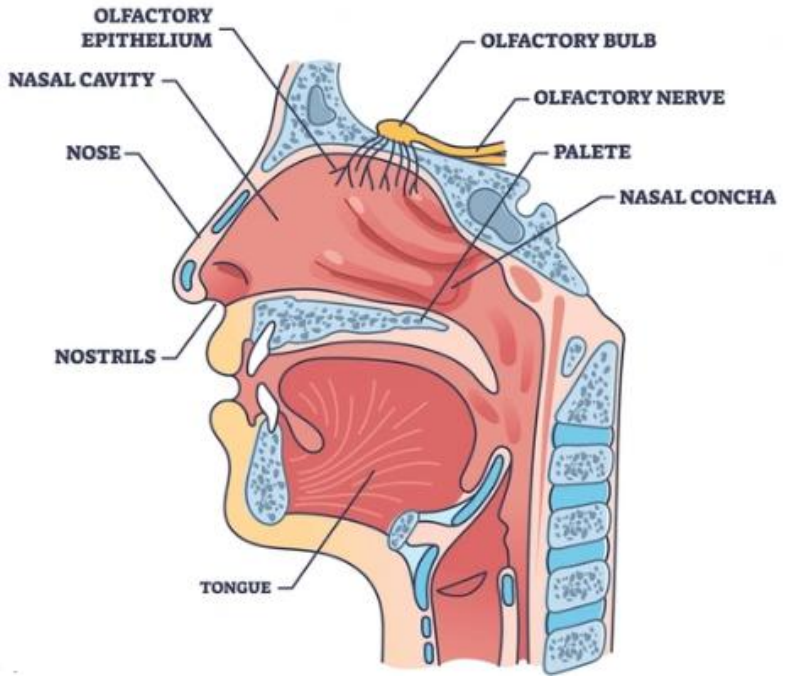
The olfactory receptors are buried in two patches of yellowish mucous membrane called the olfactory epithelium, which are about seven centimetres up from each nostril.

Humans have about 20 million receptors, covering the epithelium of both our right and left nostrils.

Once activated, neurons transmit signals to the olfactory bulb of the brain, which relays those signals to the olfactory cortex.

Olfactory information is sent from there to a number of other brain areas, including higher cortical areas, thought to be involved in odour discrimination, and deep limbic areas.



ANGLIAN CRAFT BREWERS

CPL AROMAS

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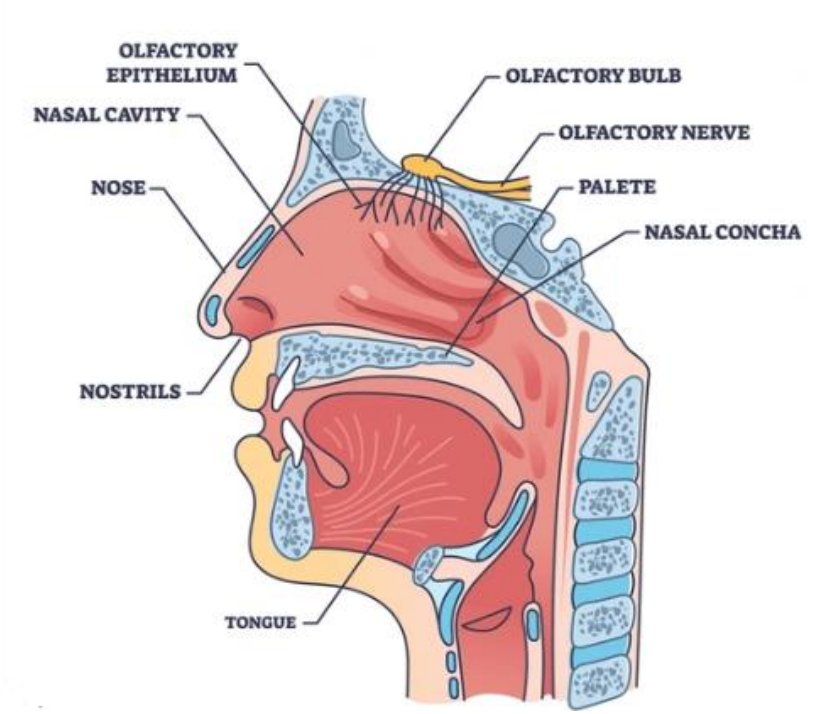
The limbic system—including the hypothalamus, the hippocampus, and the amygdala—contain the keys to our emotions.

Aroma may trigger memory, nostalgia, and mental pictures before the analytical left brain is involved.



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Although the work of Buck and Axel revealed how odours are first perceived and how the brain translates them into discrete aromas, it does not account for how they are processed within the brain.

The most common estimate is that humans can differentiate between 10,000 and 40,000 odours. However, trained perfumers, whisky blenders, and chefs may be able to discriminate upward of 100,000 odours.

As mentioned previously out of 1,000 olfactory receptors, each of us has only about 350 which are functional.

But they aren’t necessarily the same 350 receptors

This provides a biological reason why two people will perceive odours and combination of odours differently.

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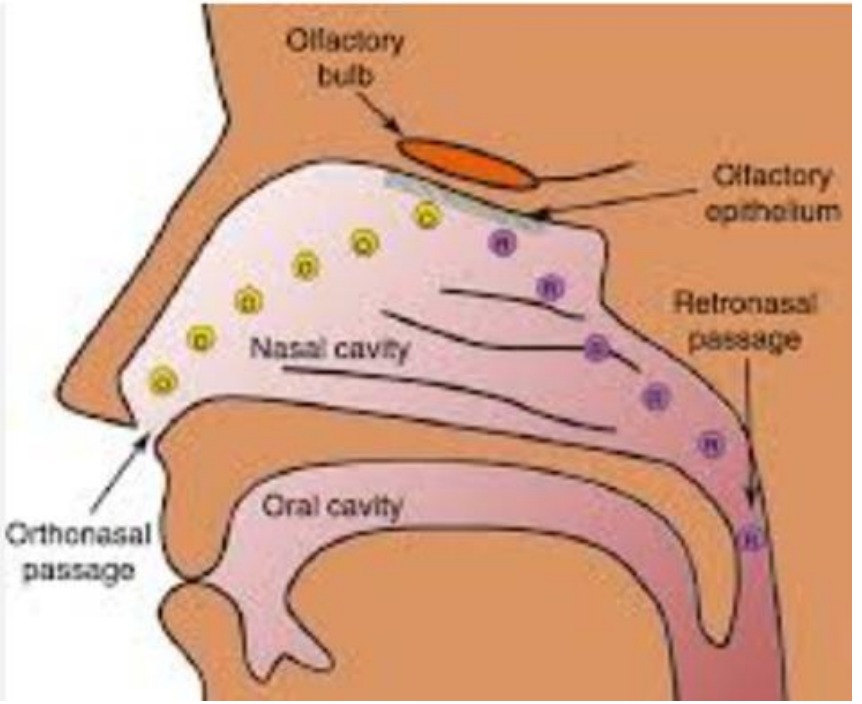
There are differences between orthonasal (breathing in) and retronasal (breathing out) perceptions of odours.

Retronasal smells activate parts of the brain associated with signals from the mouth, which helps to explain why we perceive flavour as occurring in the mouth even when the largest component is provided by what we smell.

That's one reason why a drinker might describe a beer as smelling bitter even though bitterness is a taste sensation

This psychological interplay between aroma and taste that creates flavour has obvious implications for the overall impression of any beer



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- Aromas have other psychological effects.
- Studies using EEG headband sensors to monitor brain activity indicated subjects relaxed more when concentrations of certain aromas were higher.
- Subjects relaxed more when smelling **linalol** or **geraniol**, but there were no changes when they smelled **myrcene** or **humulene**

32-33

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