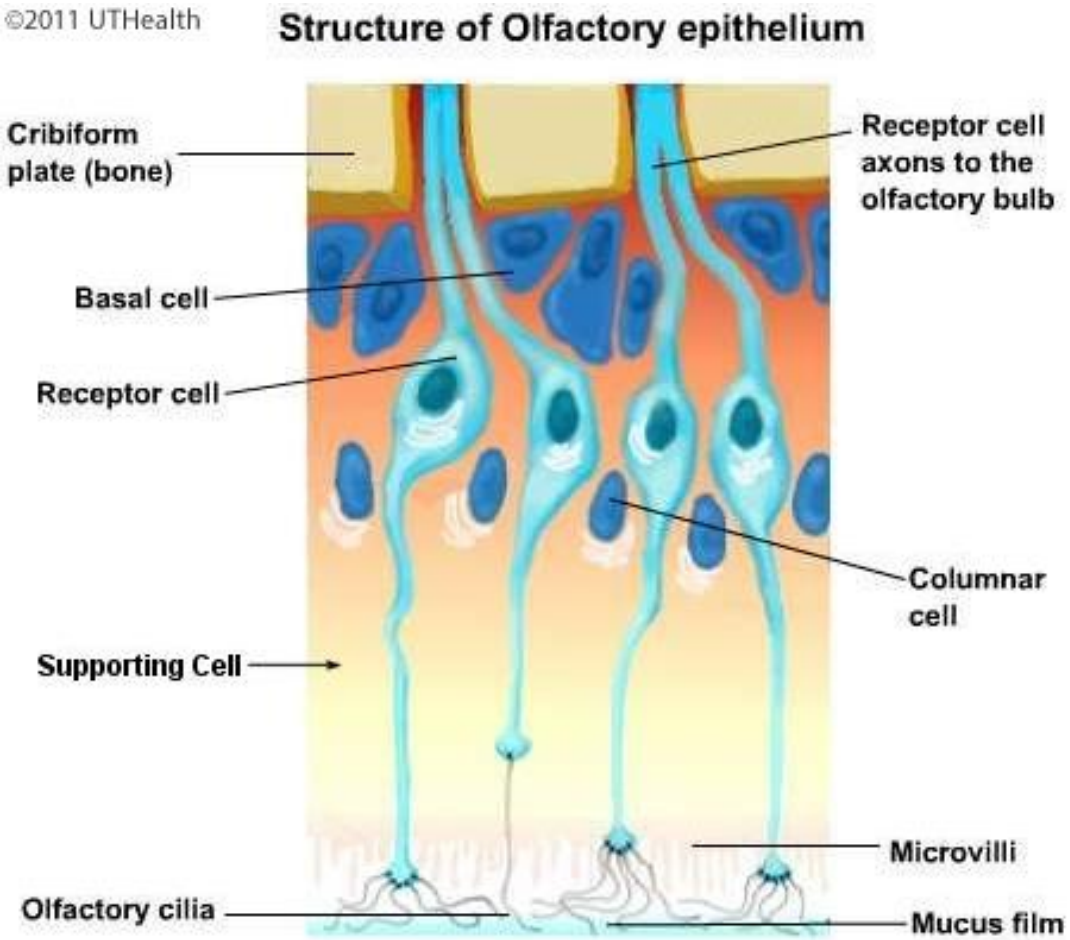
Transduction of smell

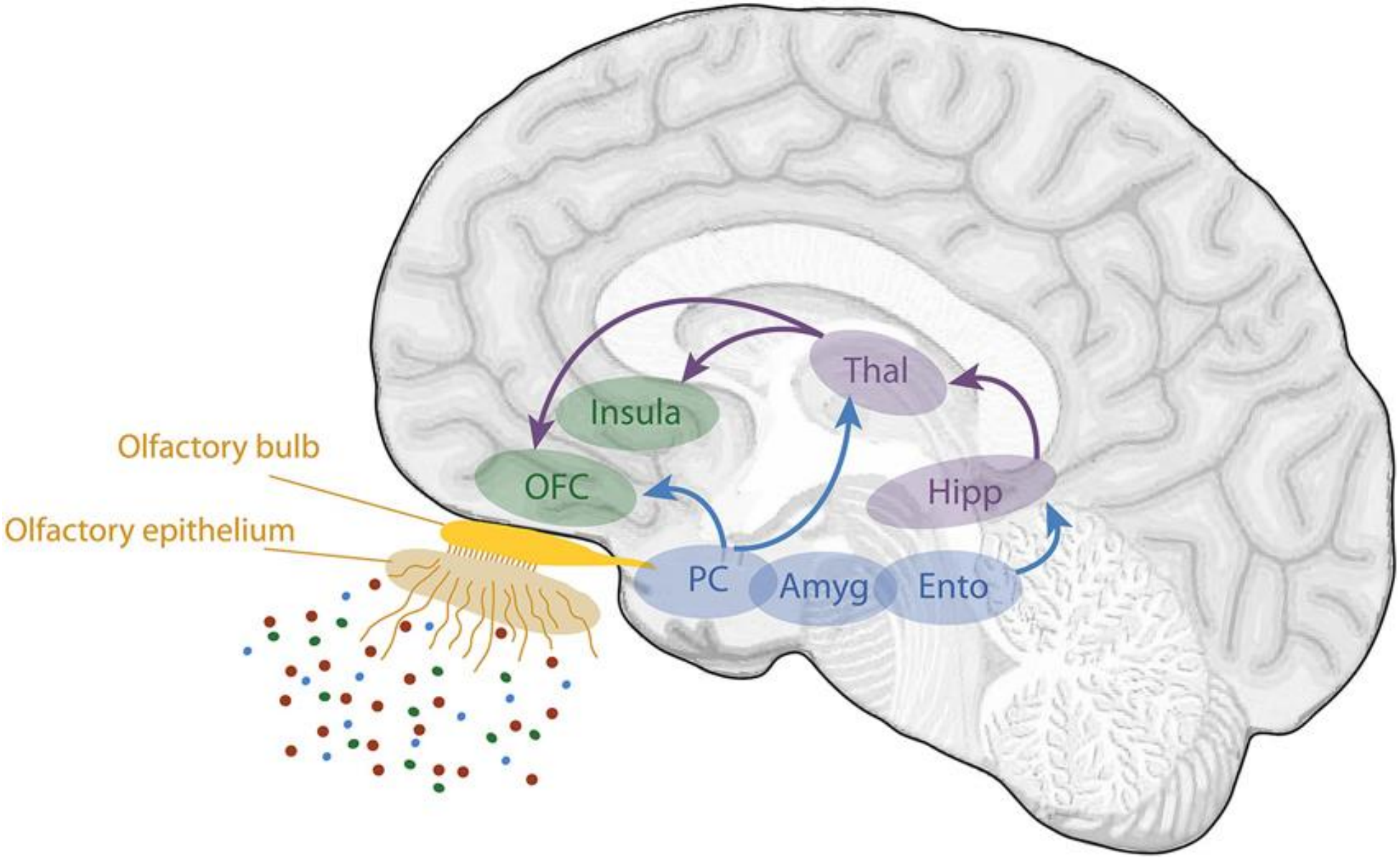
What the problem is

A smell is just a bunch of chemicals which are emitted by something

Olfactory receptors are present in the epithelium (tissue on back of nasal package).

- These have a cilia which protrudes from these cells that is in contact with the air
- These allow molecules floating around in the air to bind to the receptors they have and cause an action potential
  - There are around 400 different types of receptors, and a single odour can bind with many receptors.
  - This allows an almost infinite array of different smells to be smelt!





Amyg, amygdala; Ento, entorhinal cortex; Hipp, hippocampus;
OFC, orbitofrontal cortex; PC, piriform cortex; Thal, thalamus

Pheromones

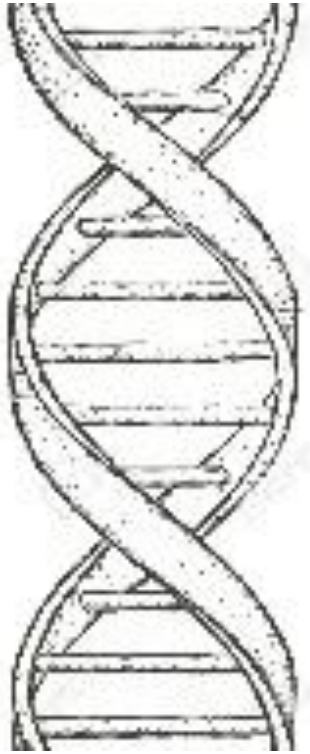
- Pheromones are single chemicals that have receptors that respond only to them that supposedly cause particular actions
  - Thus they are receptor with only one specific purpose – the most specialized of all!
- Unlike the picture, there is essentially no evidence humans have pheromones that cause sexual attraction
- There is limited evidence that infants are susceptible to pheromones secreted by the sebaceous glands in womans' nipples when breast feeding
- Alternatively, pheromones are used widely in the rest of the animal kingdom
  - Bees have at least 10 different types used. One is the "queen signal" which is a pheromone that means "defend the queen"

Interesting stuff

There are around > 1000 genes that help code our olfactory receptors, of which about 40% are functional (down from other great apes)

This is the largest family of genes in mammilian genomes.

Clearly this must have been important to us once!



Good or bad smellers?

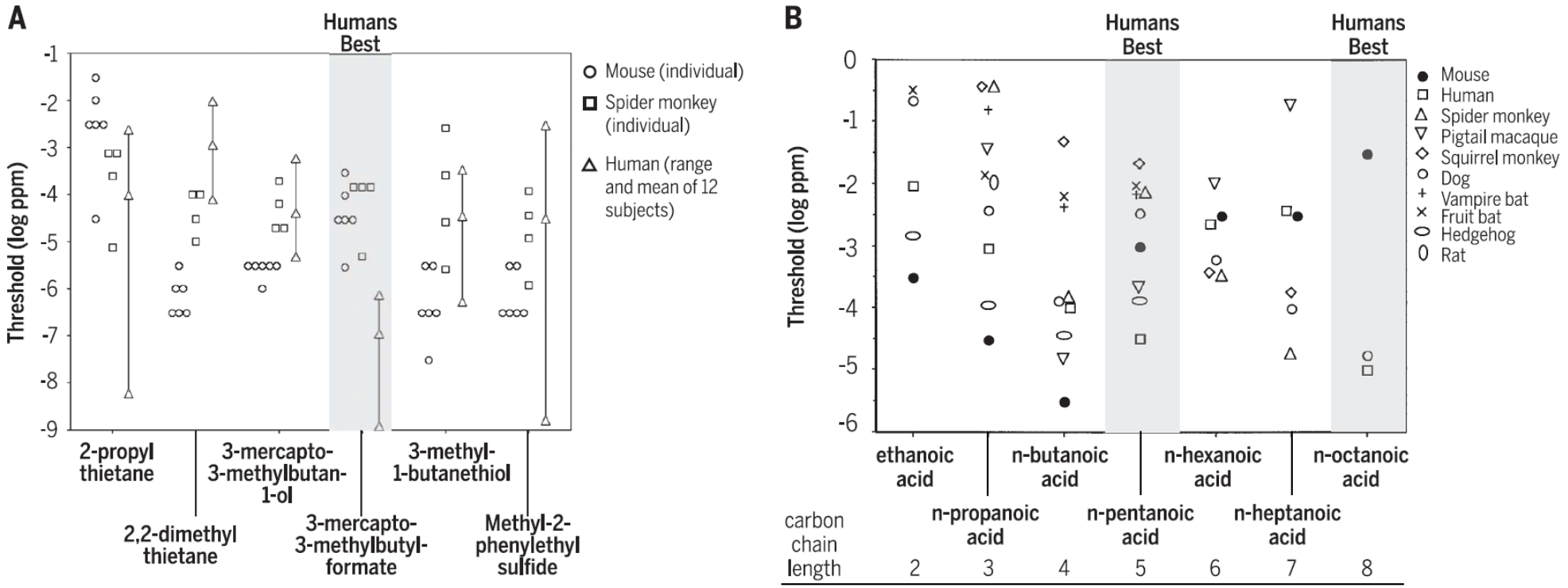


Fig. 4. Comparison of human olfactory thresholds across species and odorants. Comparison of detection thresholds (expressed as vapor-phase dilutions in log parts per million) across species, where more negative threshold values indicate lower thresholds and thus greater olfactory sensitivity. Shading indicates odors for which humans outperformed all other species tested. (**A**) Detection thresholds for human subjects (triangles), spider monkeys (squares), and mice (circles) to each of six different thresholds as measured in the Laska laboratory as part of the same experiment. Data shown are from five individual mice and spider monkeys; the triangles show the range and mean of thresholds from 12 individual subjects. All 12 humans outperformed all mice and monkeys tested for the odorant 3-mercapto-3-methylbutyl-formate and outperformed all mice for 2-propyl thietane. [Adapted from Sarrafchi *et al*. (*78*) and used by permission] (**B**) Pooled olfactory threshold values across species and laboratories for aliphatic carboxylic acids. Humans are more sensitive to *n*-pentanoic acid and *n*-octanoic acid than all other species tested. [Adapted from Can Güven and Laska (*77*) and used by permission]

From McGann (2017) Poor human olfaction is a 19th-century myth. Science, 256, eaam7263