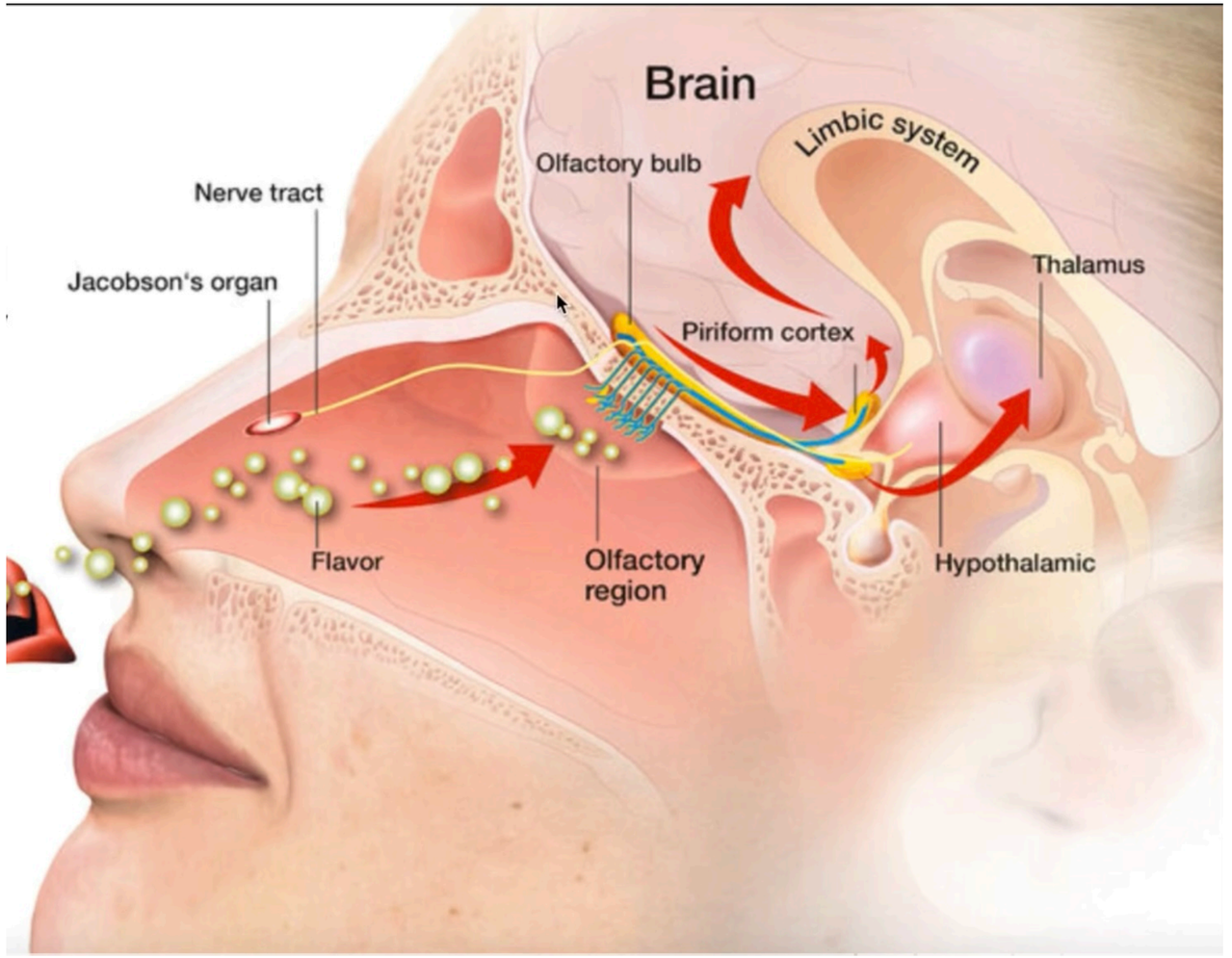
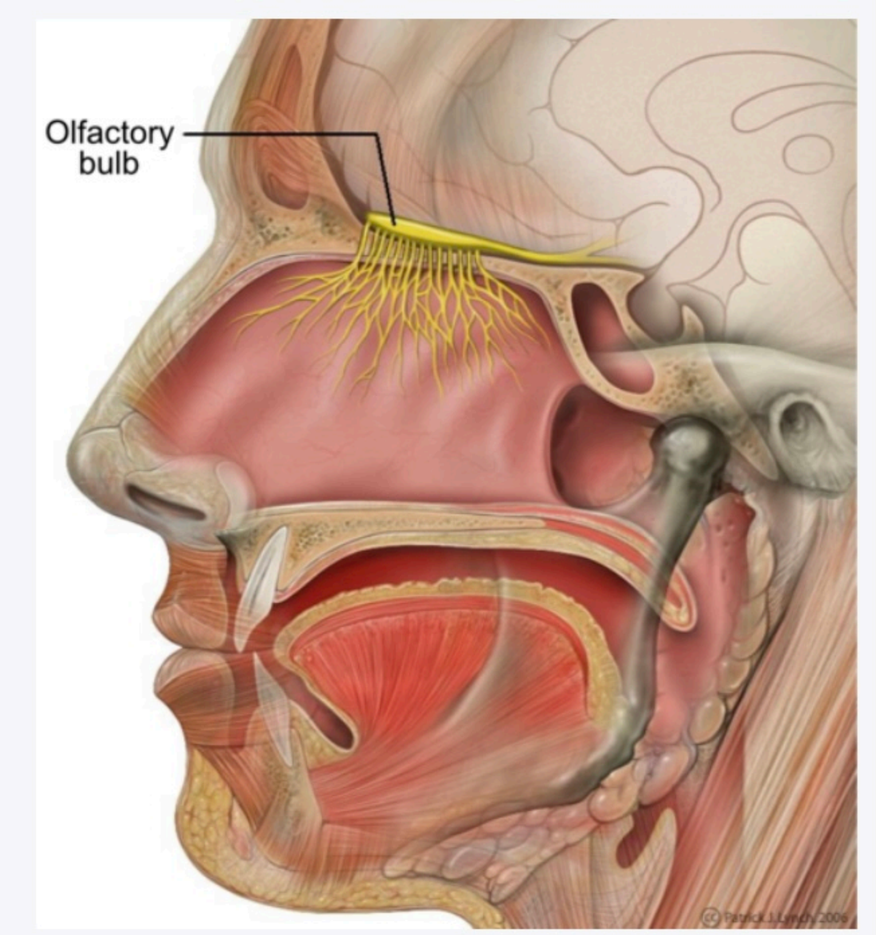
Olfactory Sense

Pat Sohler October, 2024

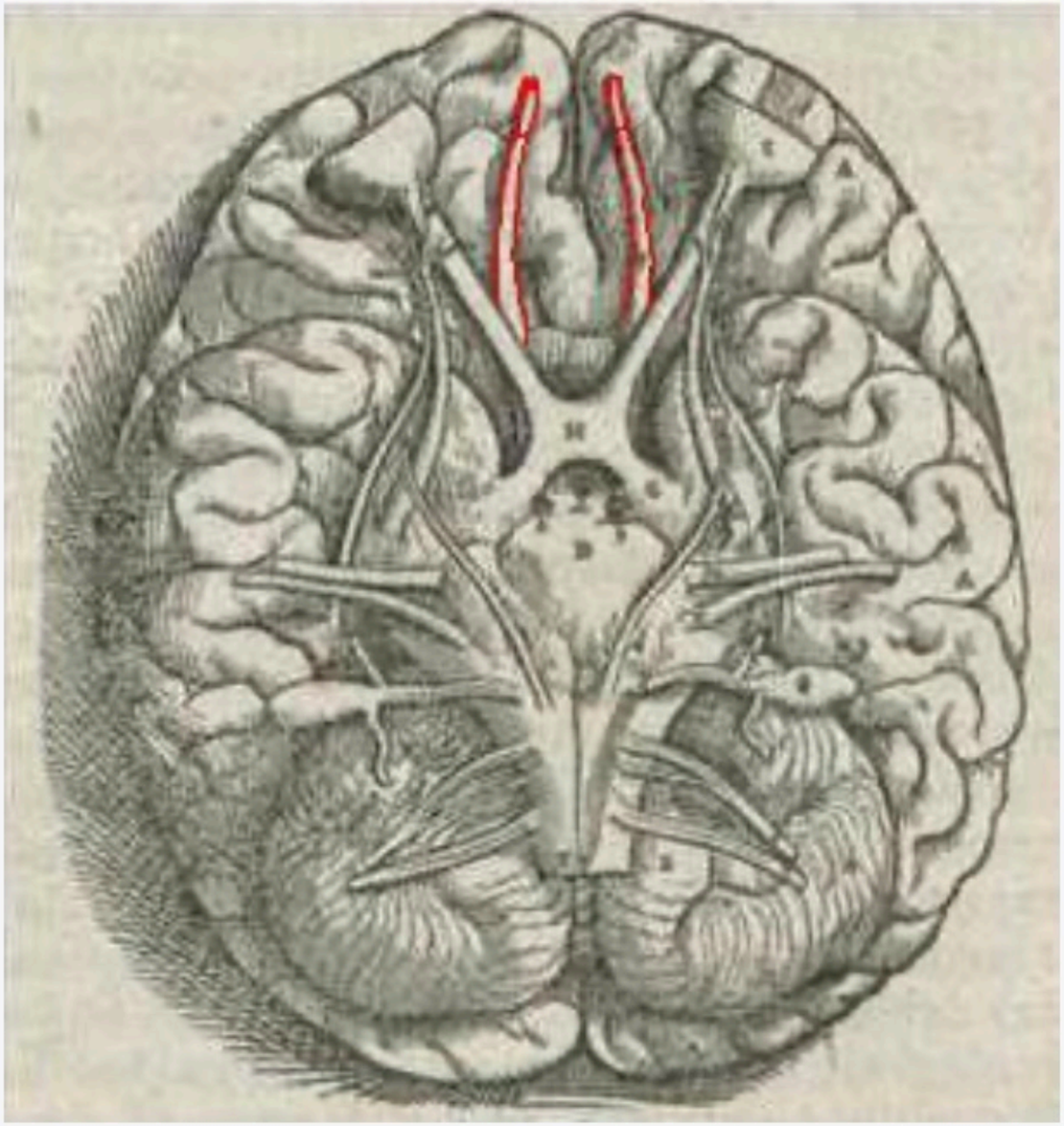
Anatomy of the Human Nose



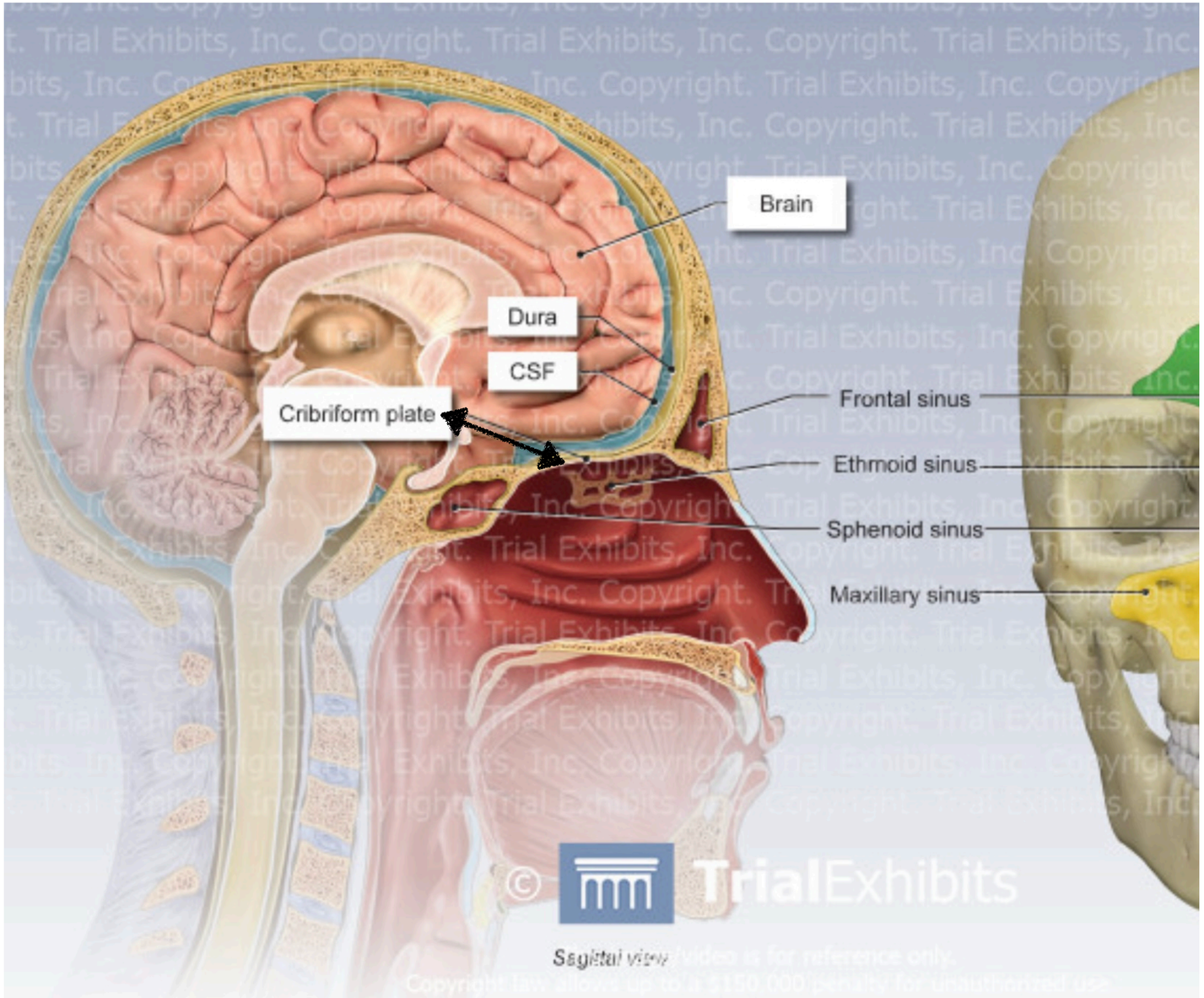
Where are the Olfactory Bulb and Olfactory Nerves



Olfactory bulb



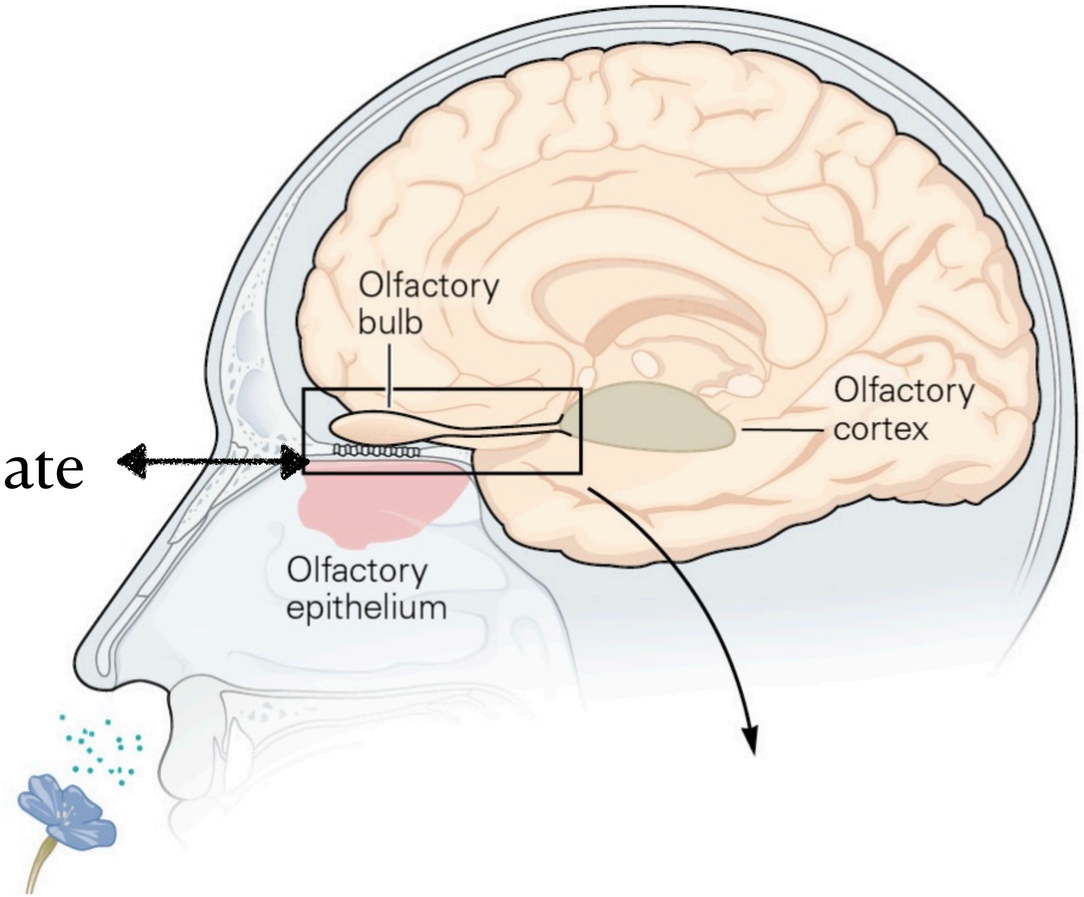
Where is the Cribiform Plate?



Olfactory Nerves

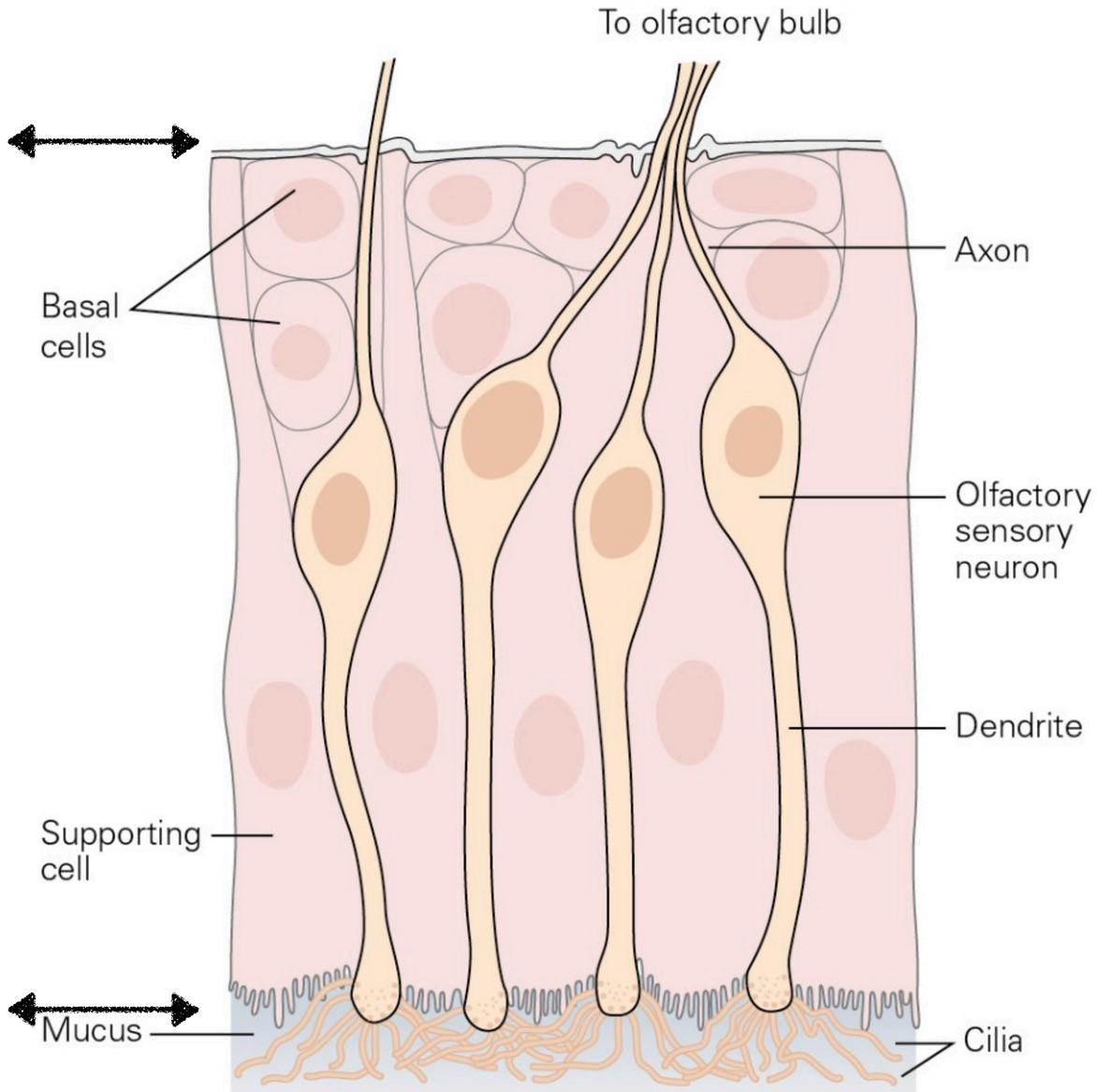
Principles of Neural Science, Sixth Edition

Cribiform Plate



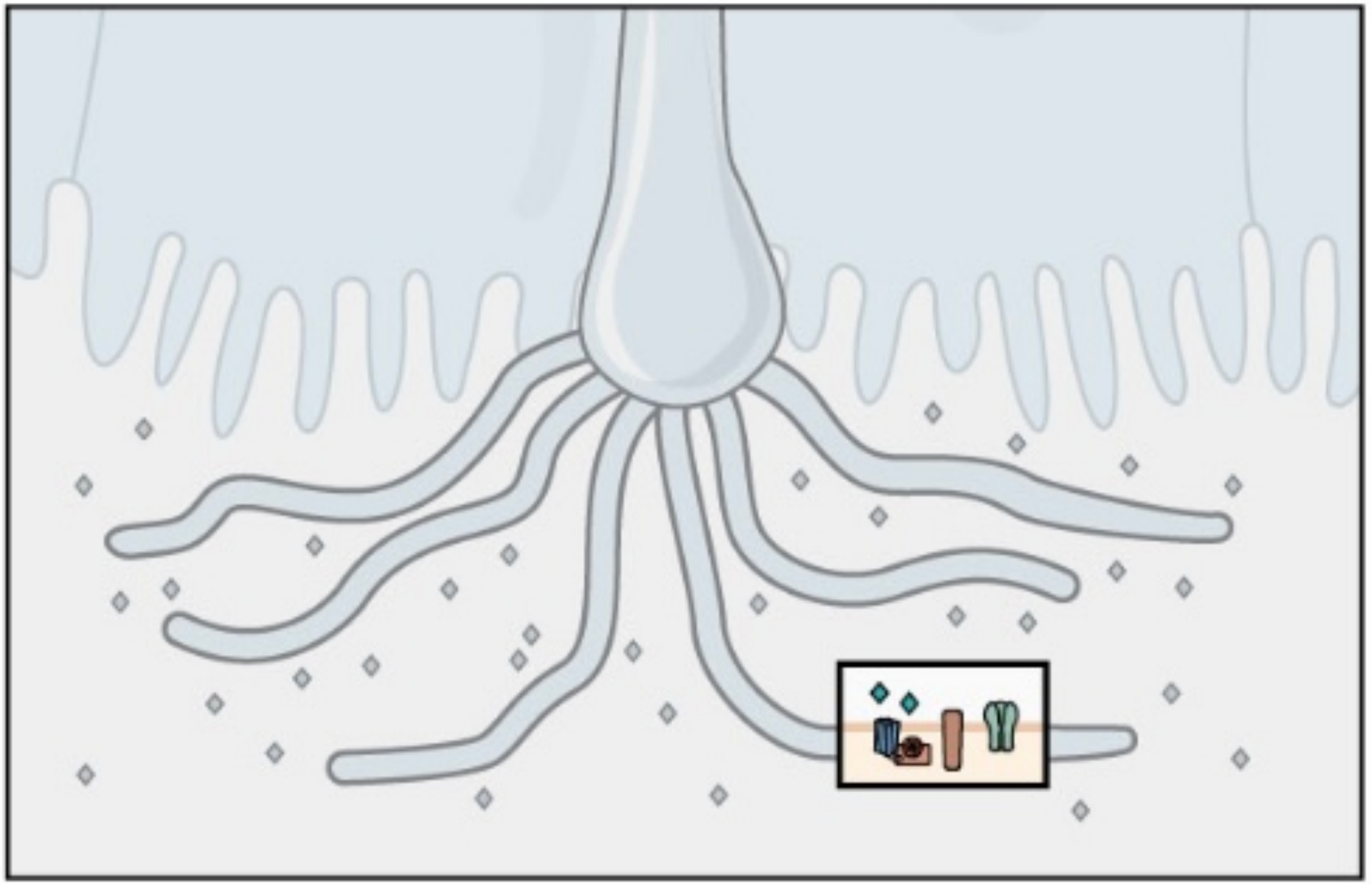
Olfactory Epithelium

Cribiform Plate

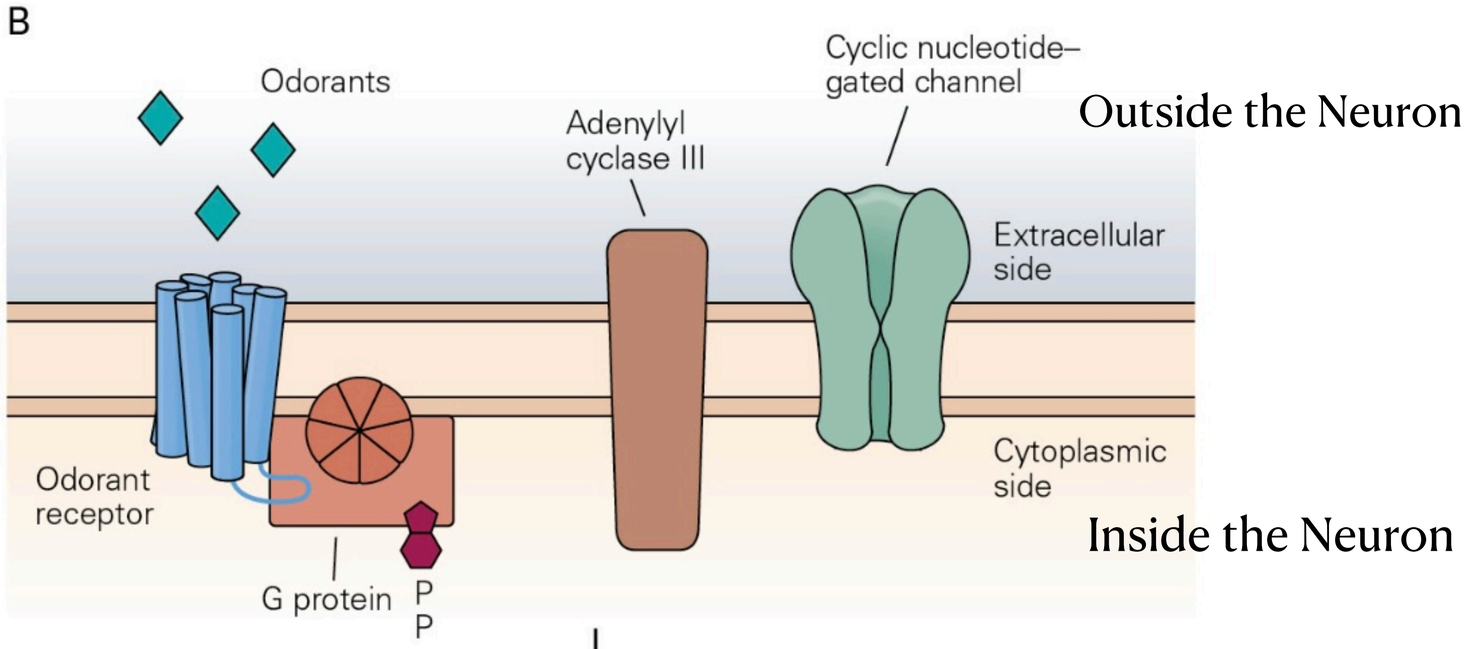


Roof of Nasal Cavity

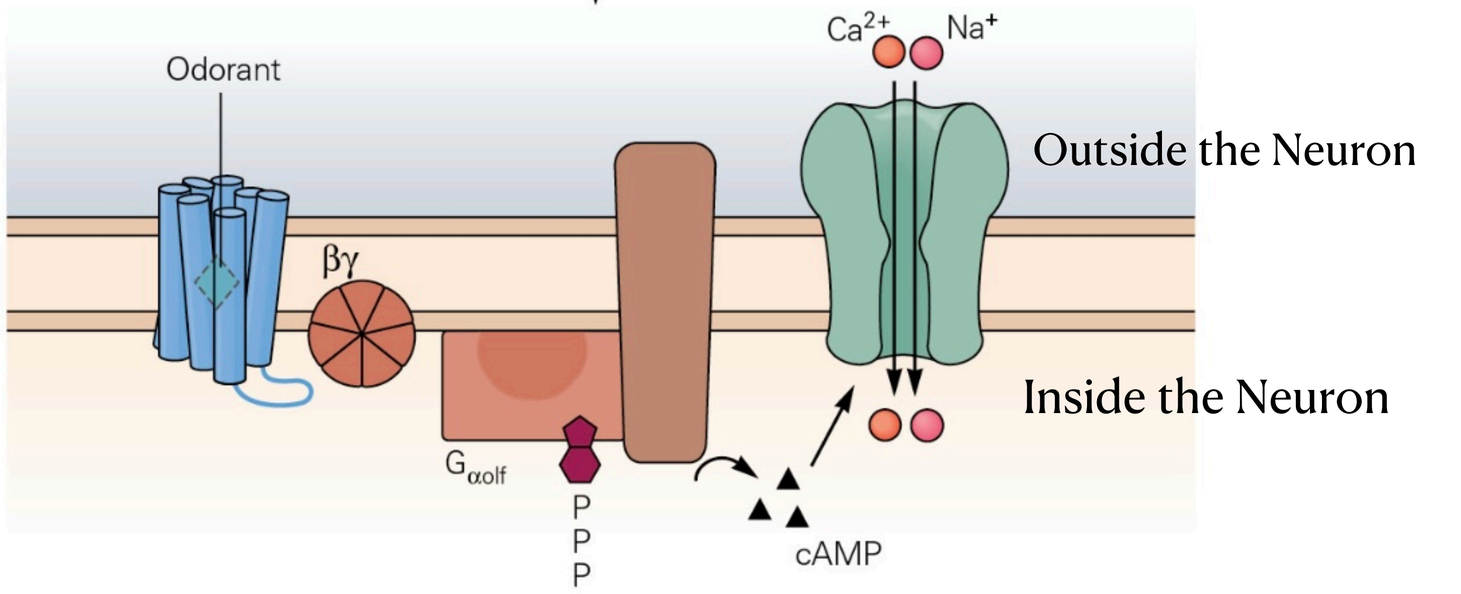
Olfactory Cilia and Receptors



Before the odorant attaches to receptor

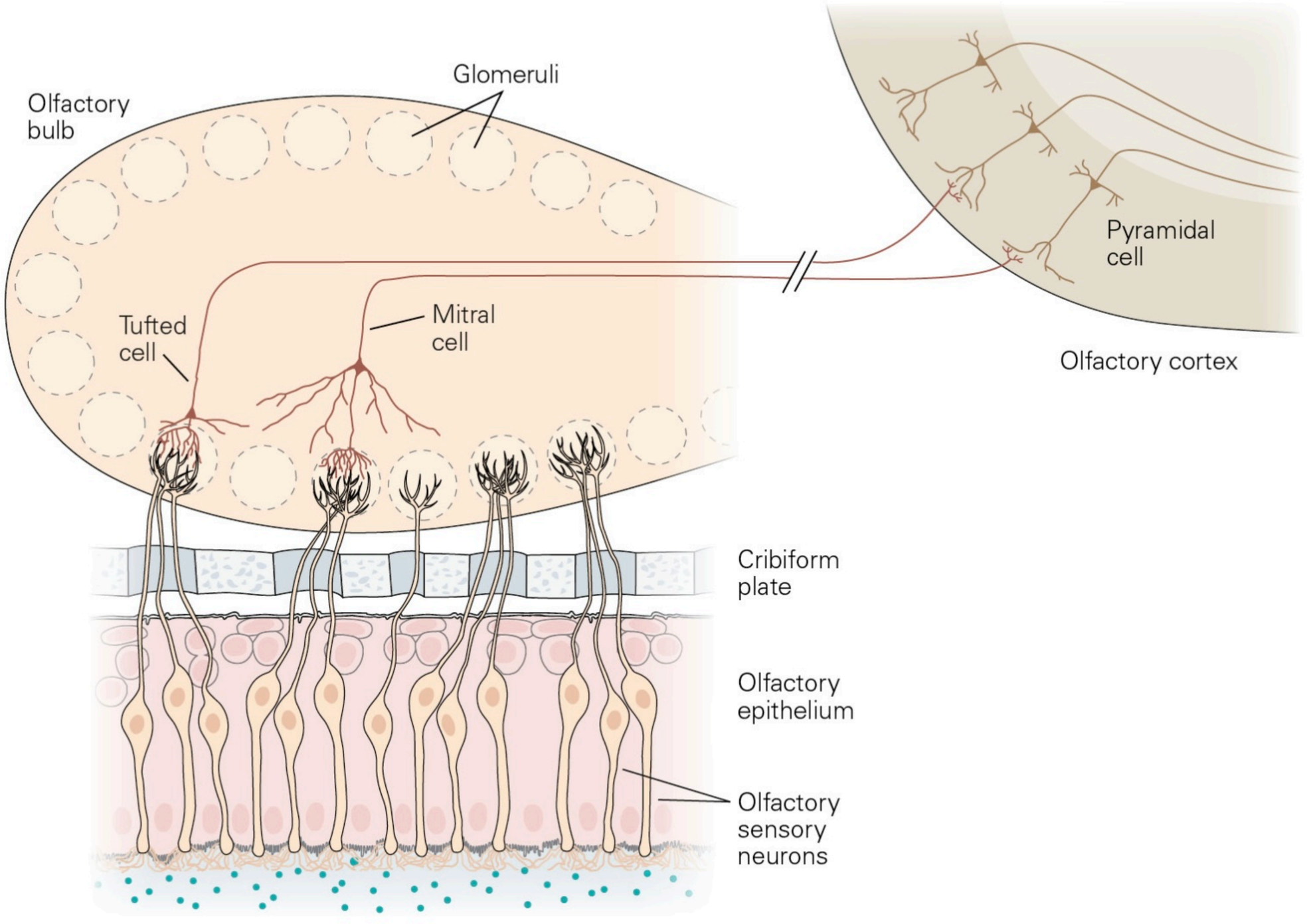


After the odorant attaches to the receptor



Cascade of actions when an odorant binds to a receptor

- When an odorant binds with its receptor, that causes the receptor to change its connection with a subunit of a G-Olfactory protein
- An immediate and rapid cascade of chemical processes excites other proteins in the neuron
- As a result of this excitation, a channel in the cell membrane opens
- This opening of the channel allows sodium and calcium ions (positively charged) to move from outside to inside the neuron, resulting in a change in the polarity inside the neuron to become less negative
- If the change in polarity is significant enough to reach threshold, an action potential is produced - From resting potential of -70 millivolts to above the threshold of -55 millivolts

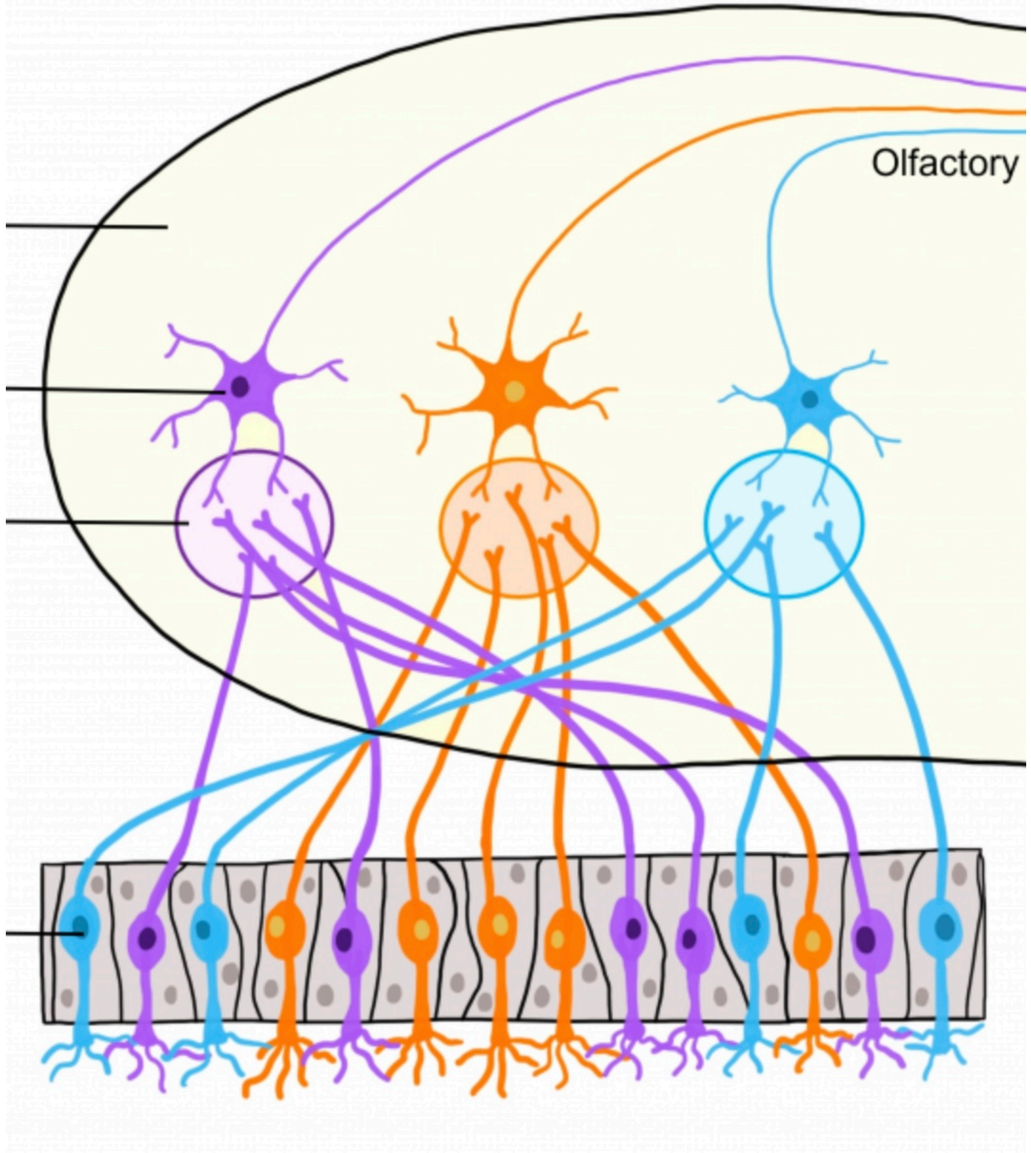

Glomeruli
Olfactory bulb
Pyramidal cell
Tufted cell
Mitral cell
Olfactory cortex
Cribiform plate
Olfactory epithelium
Olfactory sensory neurons

Synapse Video

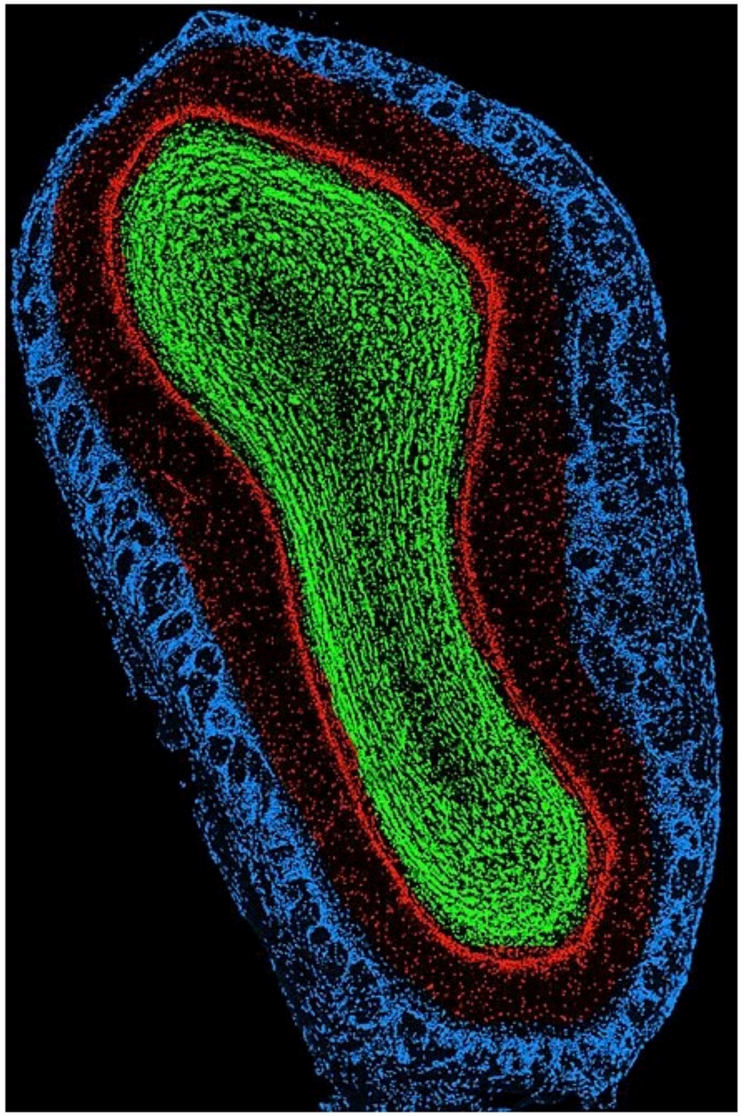
https://youtu.be/VitFvNvRIIY?si=hoNN0Hxj_bXJe3In

Sent from my iPad

Only One Kind of Receptor in Each Glomerulus



Mouse Olfactory Bulb



Coronal image of mouse main olfactory bulb cell nuclei.

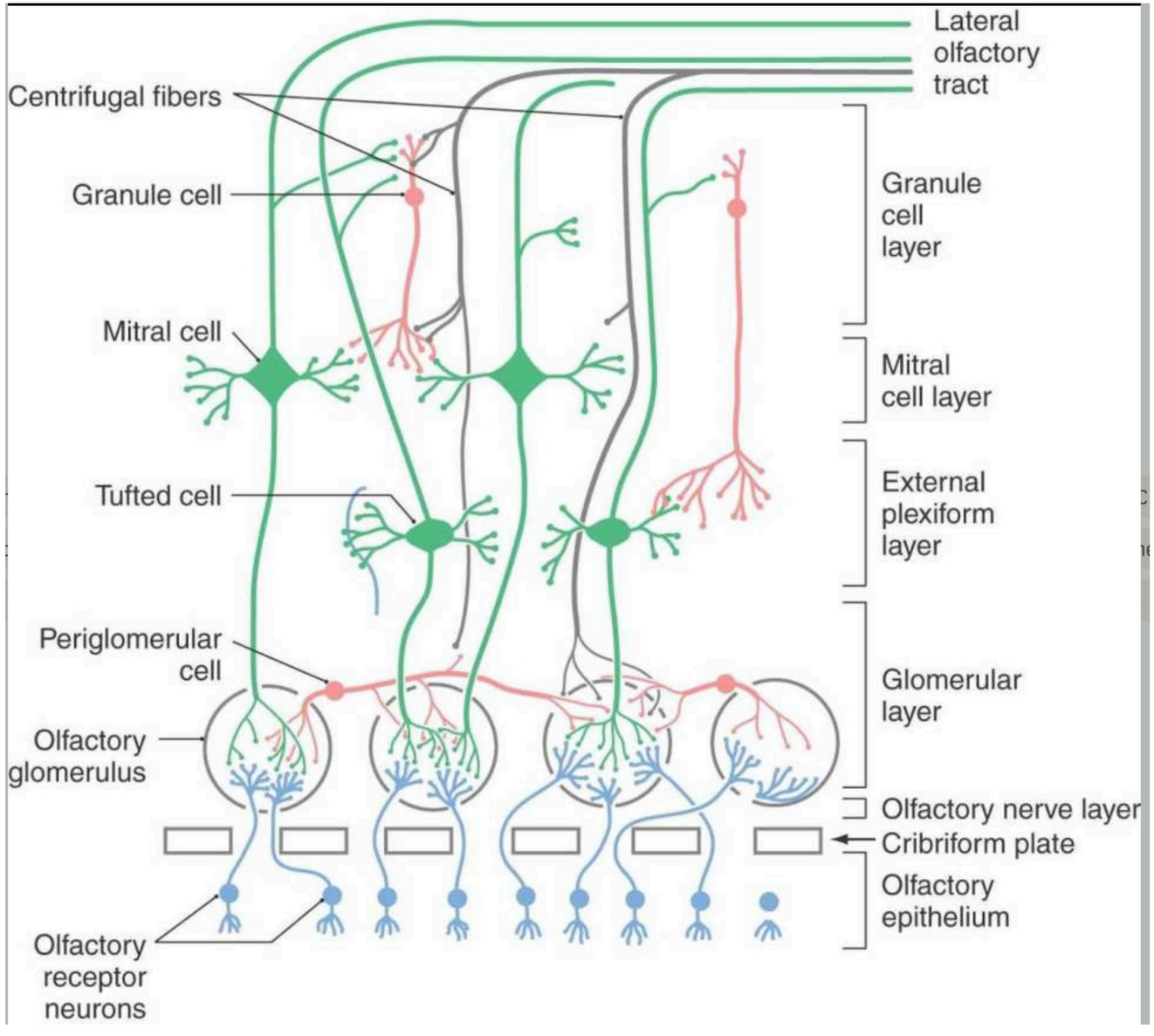
Blue – Glomerular layer;

Red – External Plexiform and Mitral cell layer;

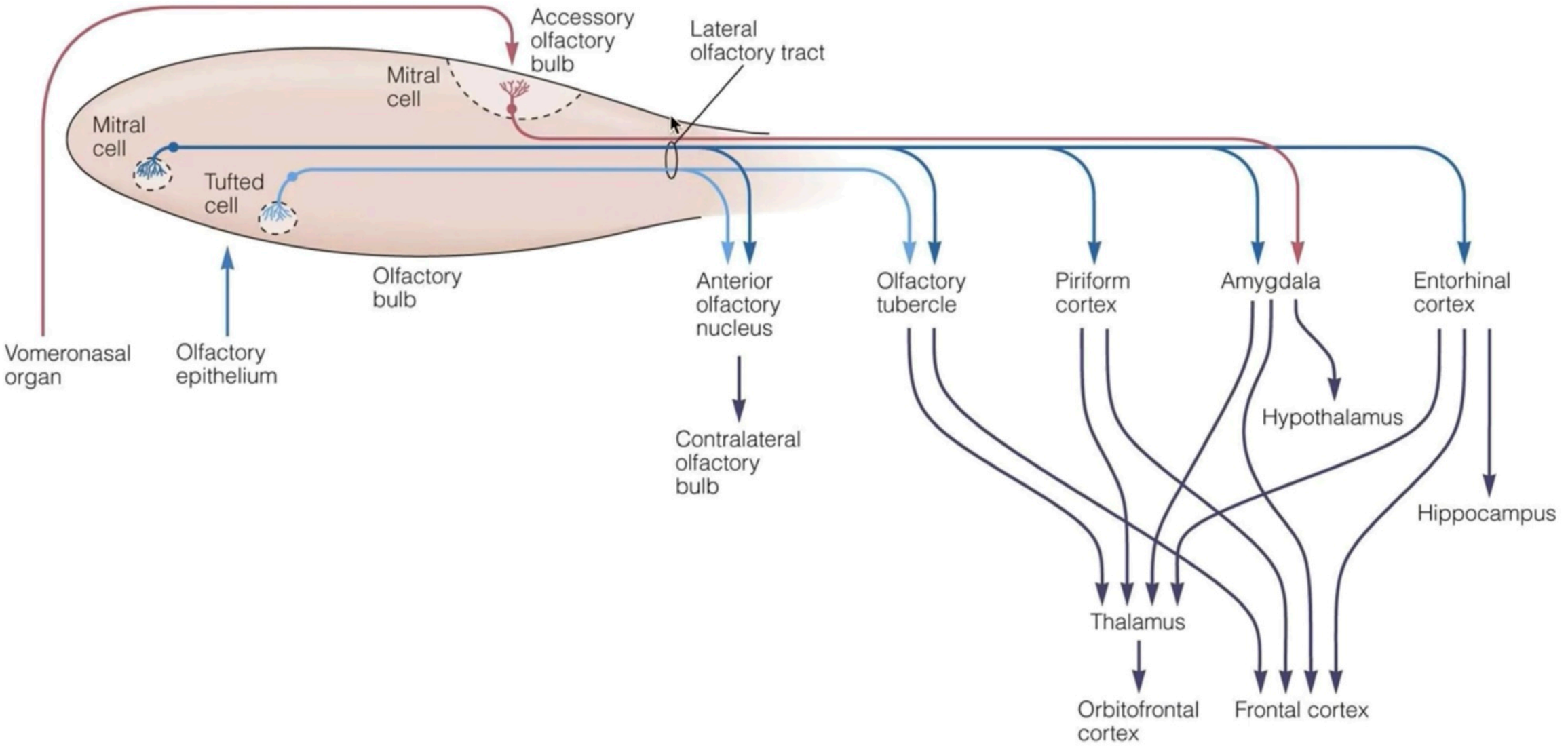
Green – Internal Plexiform and Granule cell layer.

- Top of image is dorsal aspect, right of image is lateral aspect. Scale, ventral to dorsal, is approximately 2mm.

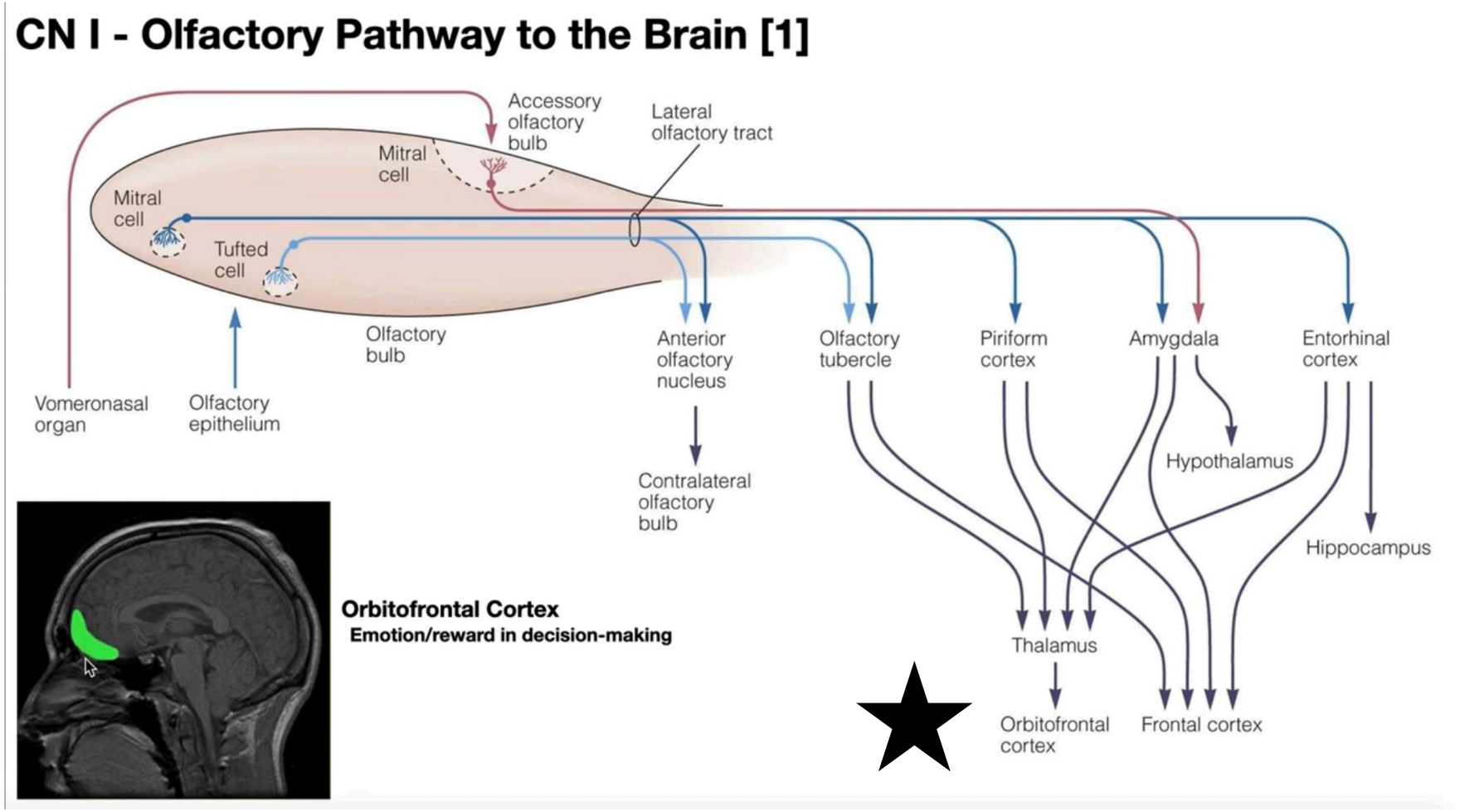
Olfactory Bulb Layers - Inhibitory Cells



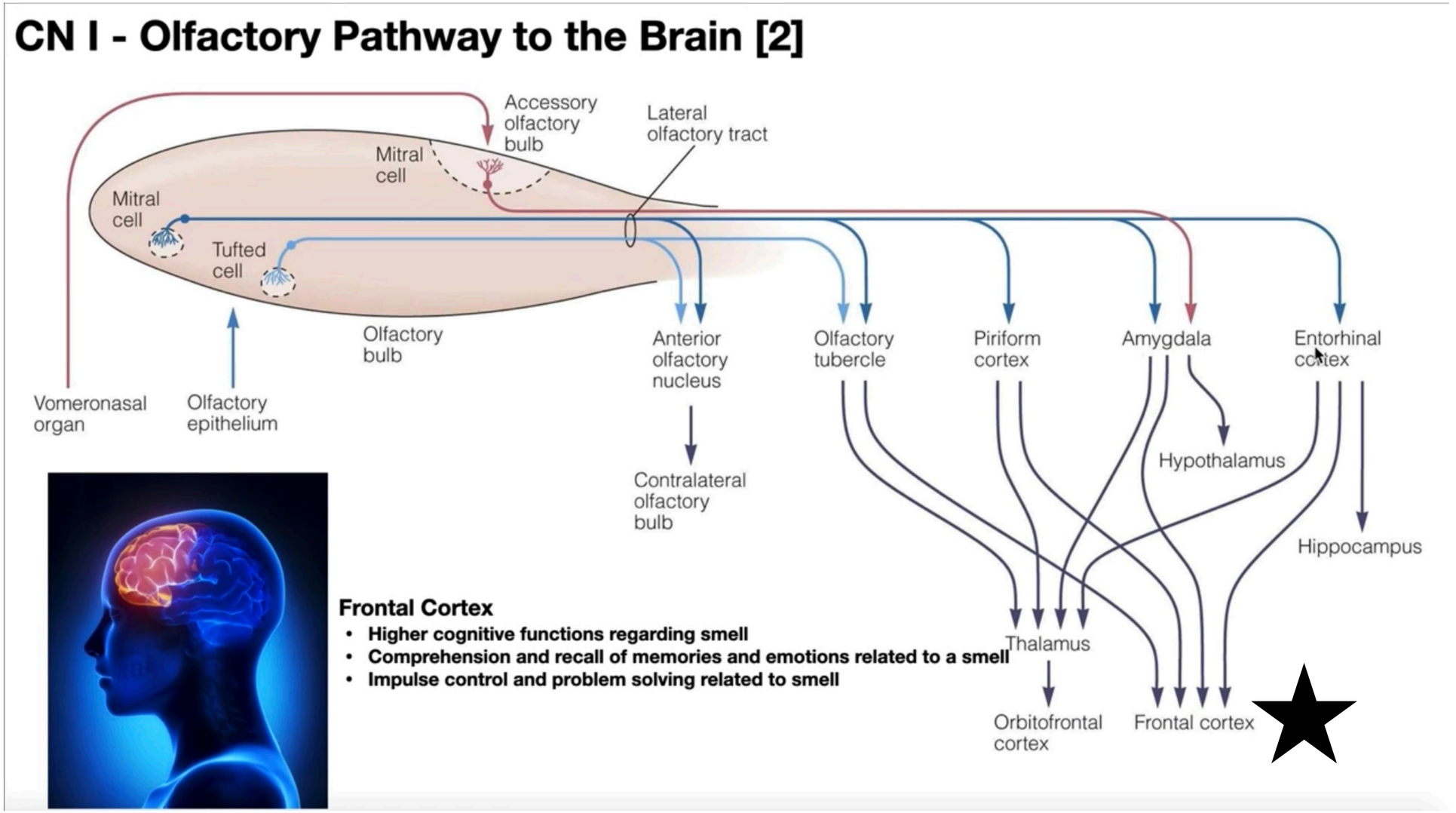
CN I - Olfactory Pathway to the Brain



Olfactory to Orbitofrontal Cortex

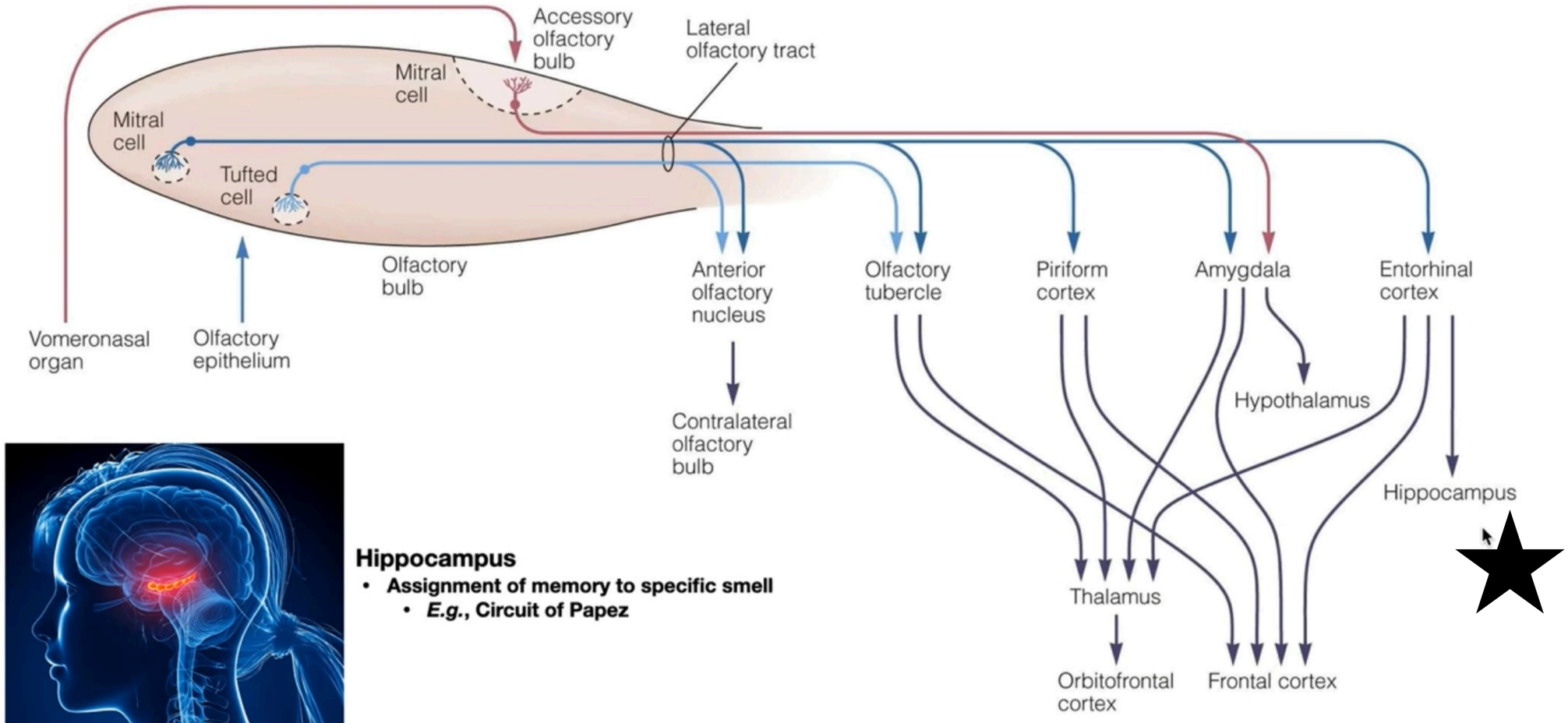


Olfactory Pathway Frontal Cortex



Olfactory Pathway Hippocampus

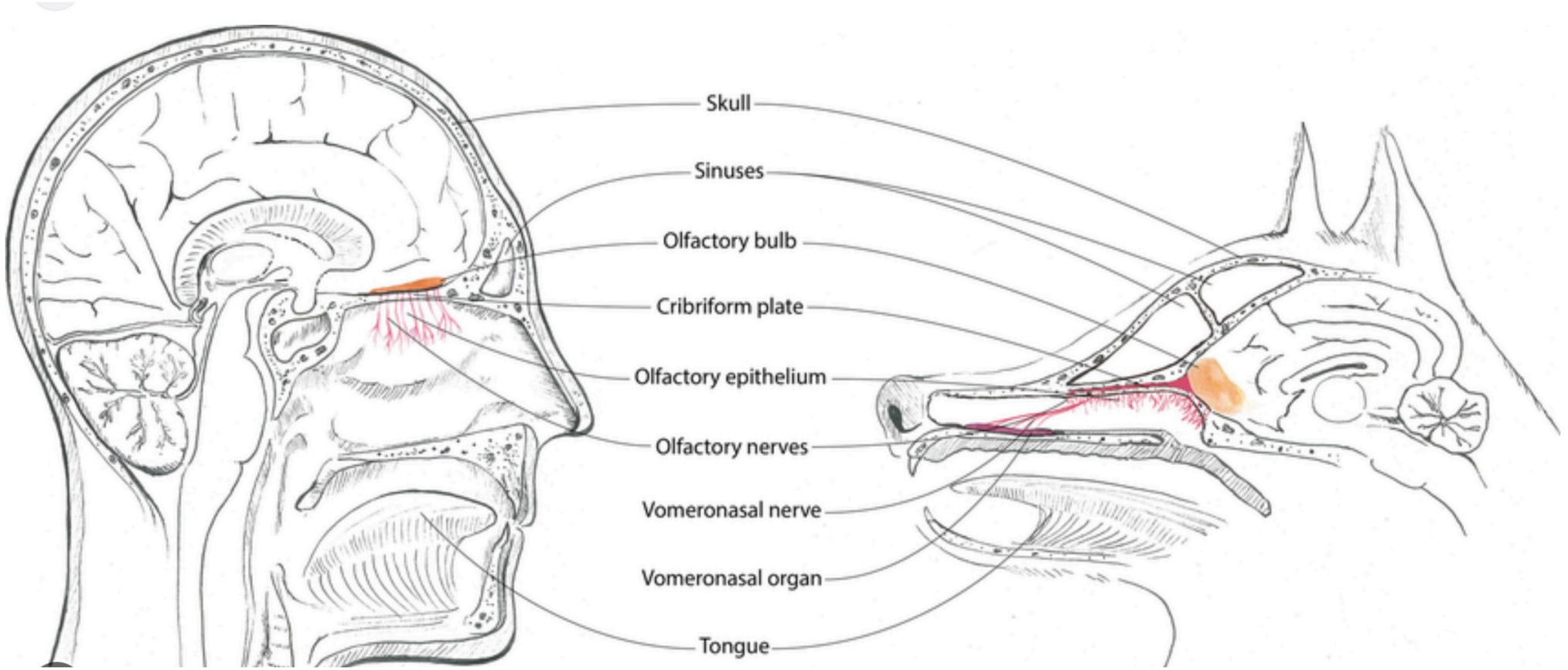
CN I - Olfactory Pathway to the Brain [3]



Hippocampus

- **Assignment of memory to specific smell**
  - ***E.g.*, Circuit of Papez**

Olfactory System Man Vs. Dog



Your Dog's Nose Video

https://youtu.be/Gf4k0VgCQjg?si=u4oPJ-yCt4_Rmj-s

Sent from my iPad

Dog Olfactory Breathing

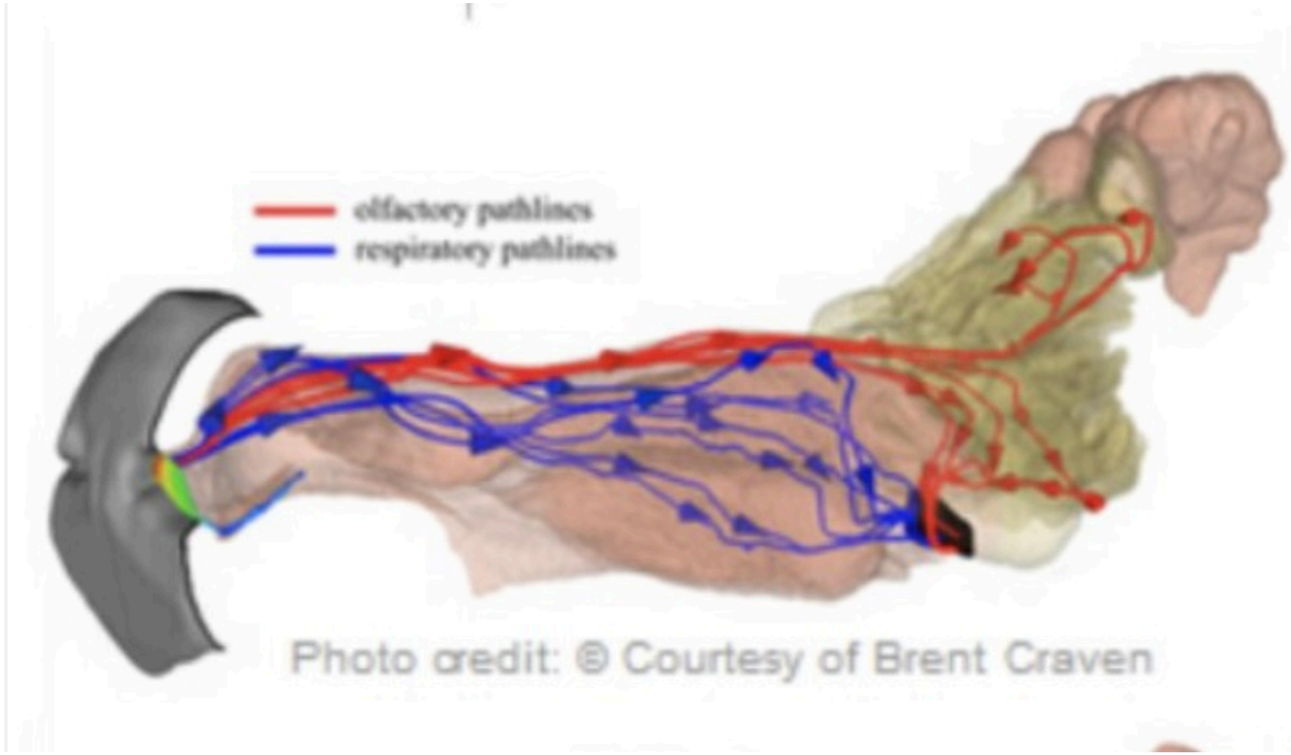


Photo credit: © Courtesy of Brent Craven

Figure 1: When a dog breathes in, the air separates into distinct paths, one (red) flowing into the olfactory area and the other (blue) passing through the pharynx (black) to the lungs.

Dog Olfactory Receptors

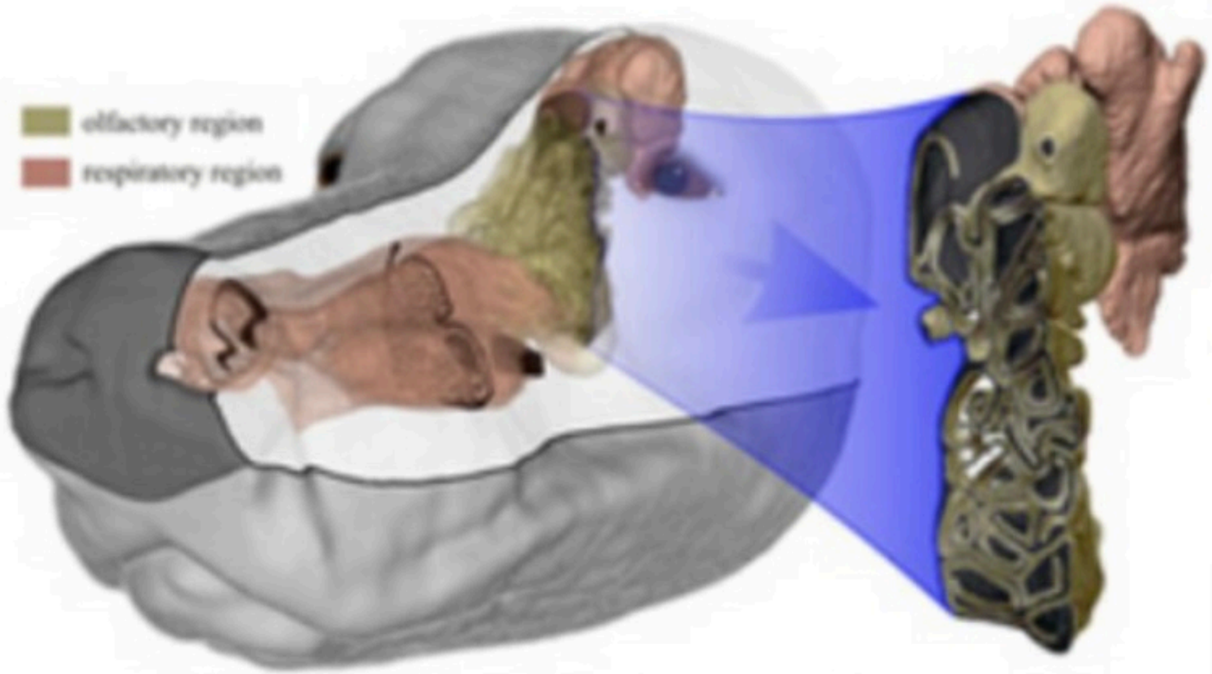


Photo credit: © Courtesy of Brent Craven

Figure 2: In the rear of a dog's nose lies the olfactory region (yellowish-brown), with its scroll-like tissues bristling with smell receptors. Respiratory regions appear in pink.

Dog Nose Sensitivity

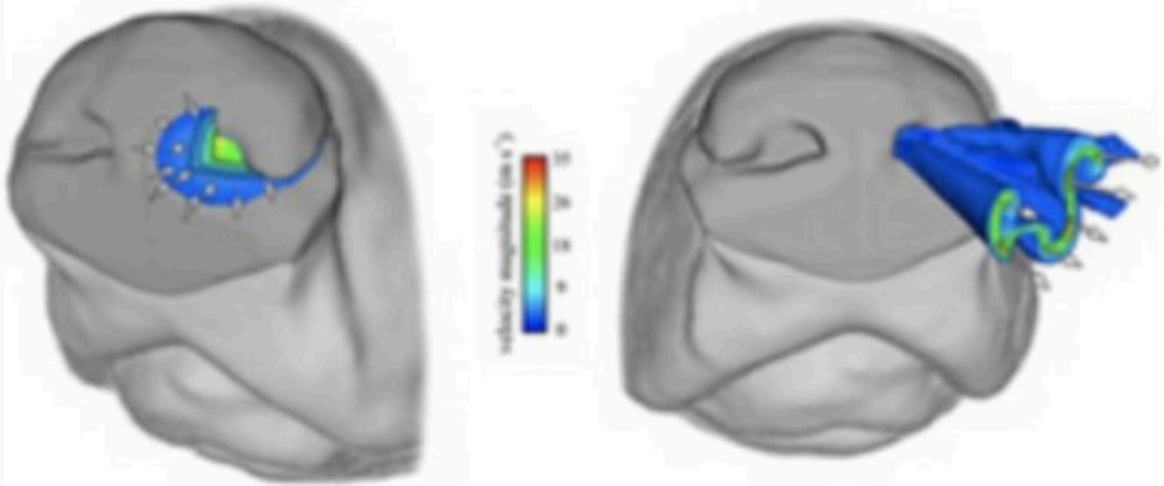


Photo credit: © Courtesy of Brent Craven

Figure 3: When a dog breathes in (far left), it can tell which nostril an odor arrived in because each nostril's "aerodynamic reach" (blue) is so small. When a dog breathes out (near left), the expired air blows out the side slits in such a way as to augment the sampling of new odors.