

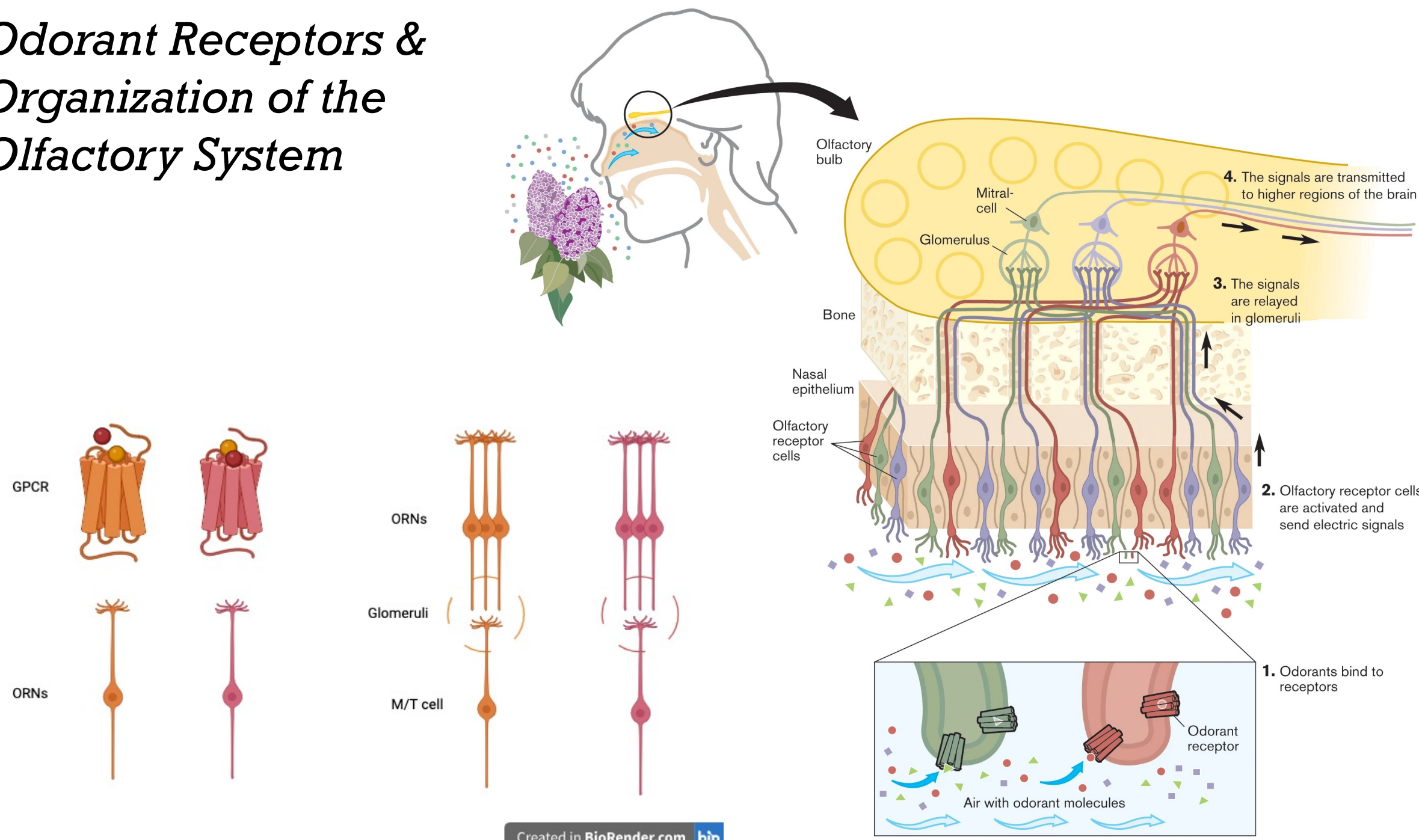
Olfactory System Overview: Organization, Processes, Roles, & Disorders



Resources

Olfactory System Introduction Mechanism & Pathways of Olfactory System

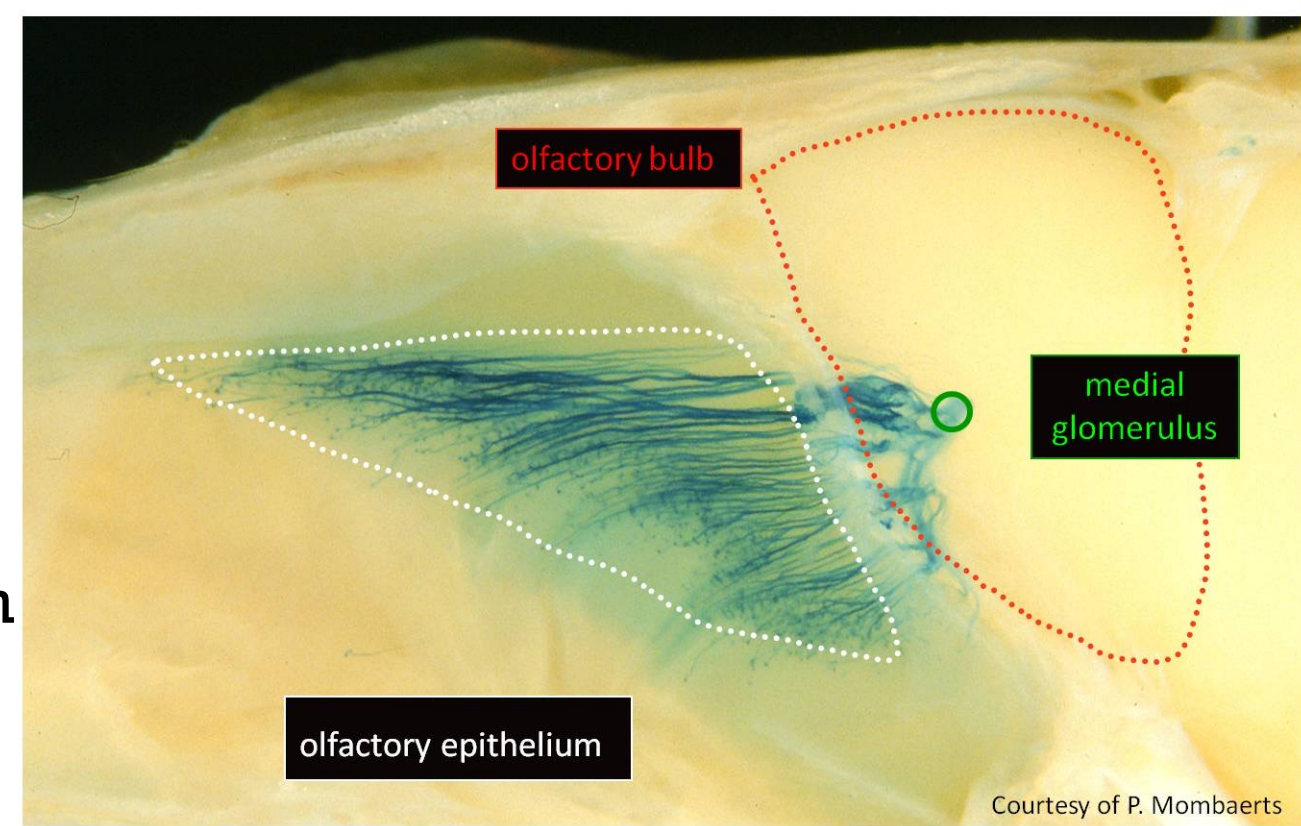
Odorant Receptors & Organization of the Olfactory System



NobelPrize.org. Nobel Prize Outreach AB 2023. Sat. 26 Aug 2023. Olfactory system & relevant processes taulacZ

Birth of Olfactory Tracing

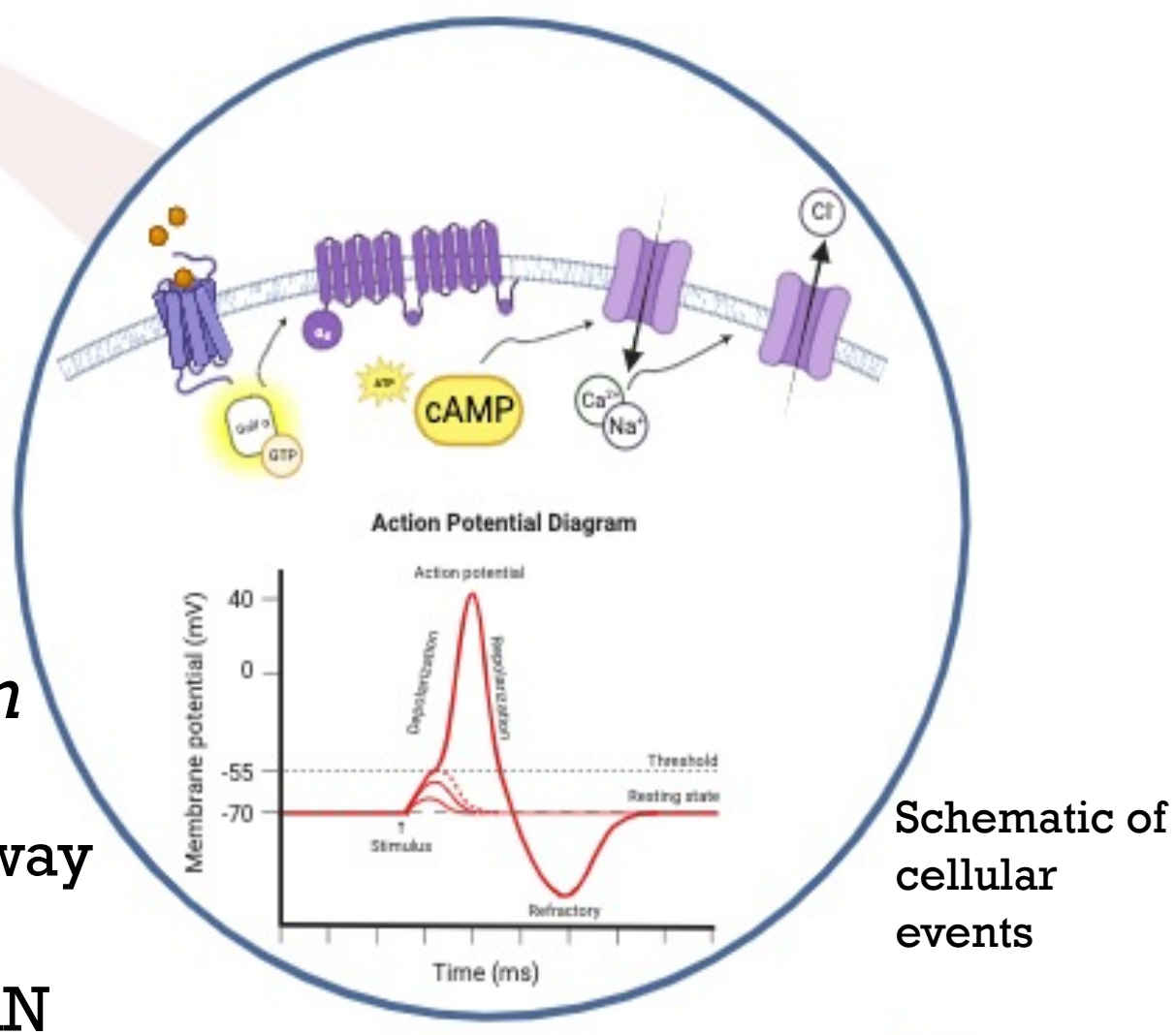
Via labeling axons using a tau MAP marker, what can be seen is the path from nasal epithelium to the glomerulus, the first contact within the brain's olfactory bulb between ORNs & mitral/tufted cells



Mombaerts et al., Cell 87 (4) 675-686 (1996) Labeling of ORN neurons to glomeruli in OB

Signal Transduction

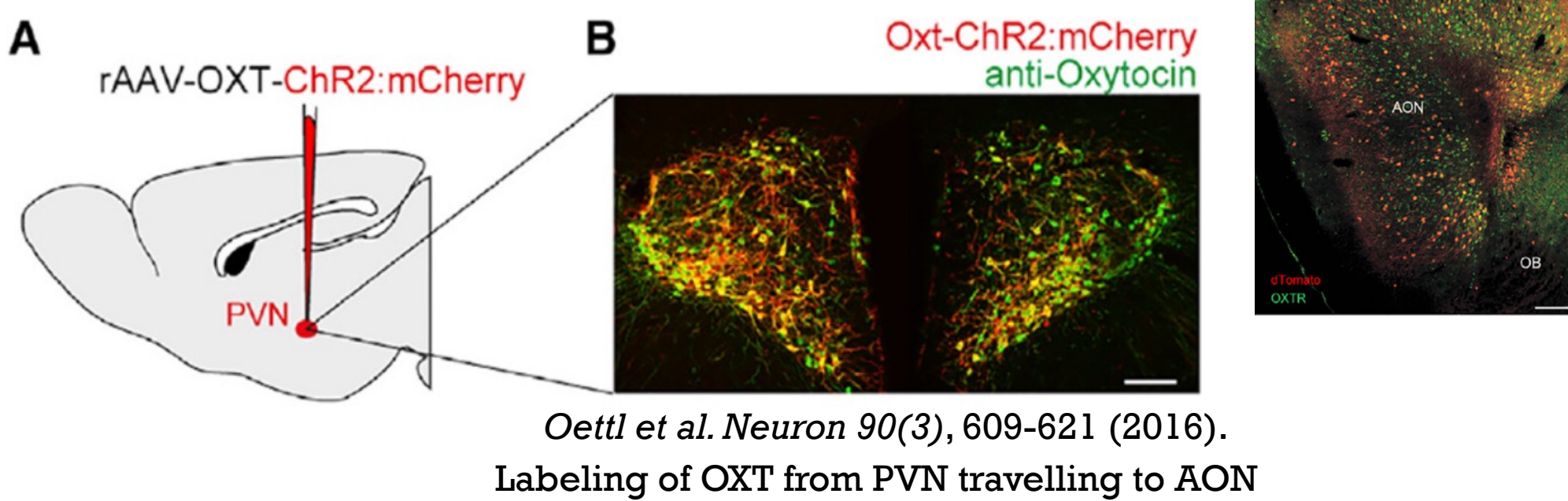
Molecular processes underway at the level of a dendritic cilia ORN GPCR cascade



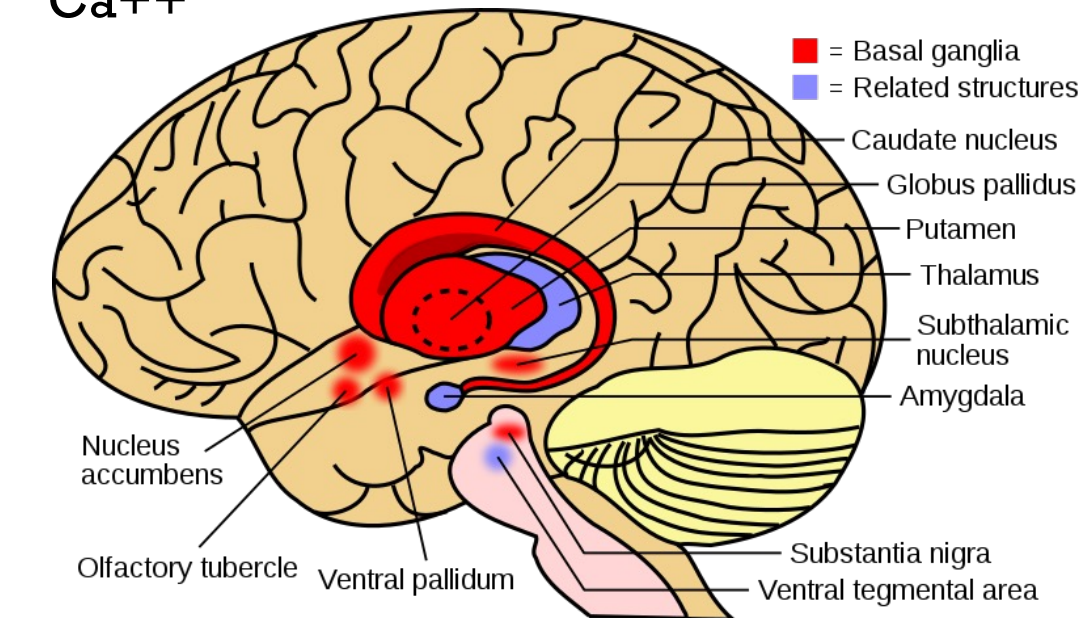
Role of Olfactory System in Different Behaviors

➤ **PV MOB** → **MeA**
Reproductive behavior → important for animals to go from sensory system to motor output

➤ **PVN OXT** → **AON**
Social recognition → OXT role in another region separate from pituitary pathway in developing recognition

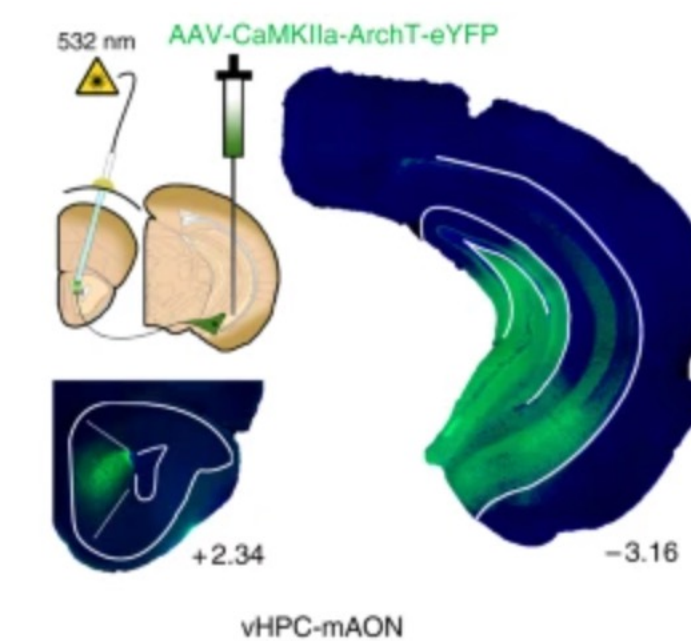


➤ **VTA** → **OT (VS)**
Odor reward & valence → social interaction leading to increased VTA Ca⁺⁺



Wikipedia Contributors. Wikipedia, The Free Encyclopedia (2023).

➤ **vHPC** → **mAON**
Odor memory & social interactions

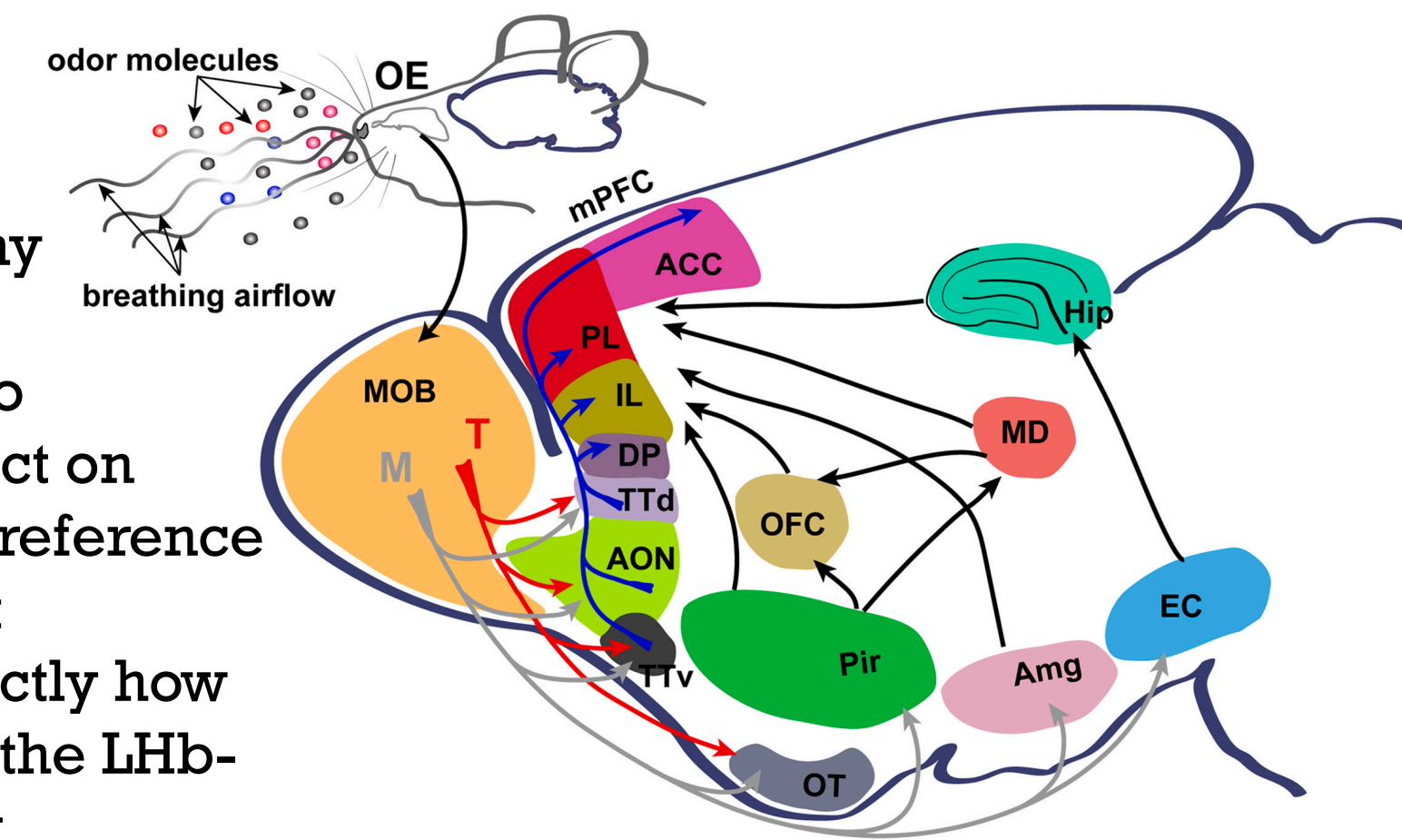


Aqrabawi et al. Nat Commun 9, 2735 (2018). ArchT injection showing optogenetic path

What is Unknown?

Present Understanding

The olfactory system has many short- & long-range projections that go throughout the brain, encompassing many different functions from odor recognition to reward to social cognition. In a part of the lab currently, DREADDs are used to temporarily inhibit a mPFC region called IL and see the effect on proxies such as familiar and novel interaction and familiar preference and novel preference using the Crawley three-chamber box paradigm. What could be done in the future is delineate exactly how the olfactory system has connections with networks such as the LHb-VTA system, sparse out the role of the mPFC and its relevant presynaptic partners, and understand how these networks are affected in anosmia, hyposmia, and inflammation.

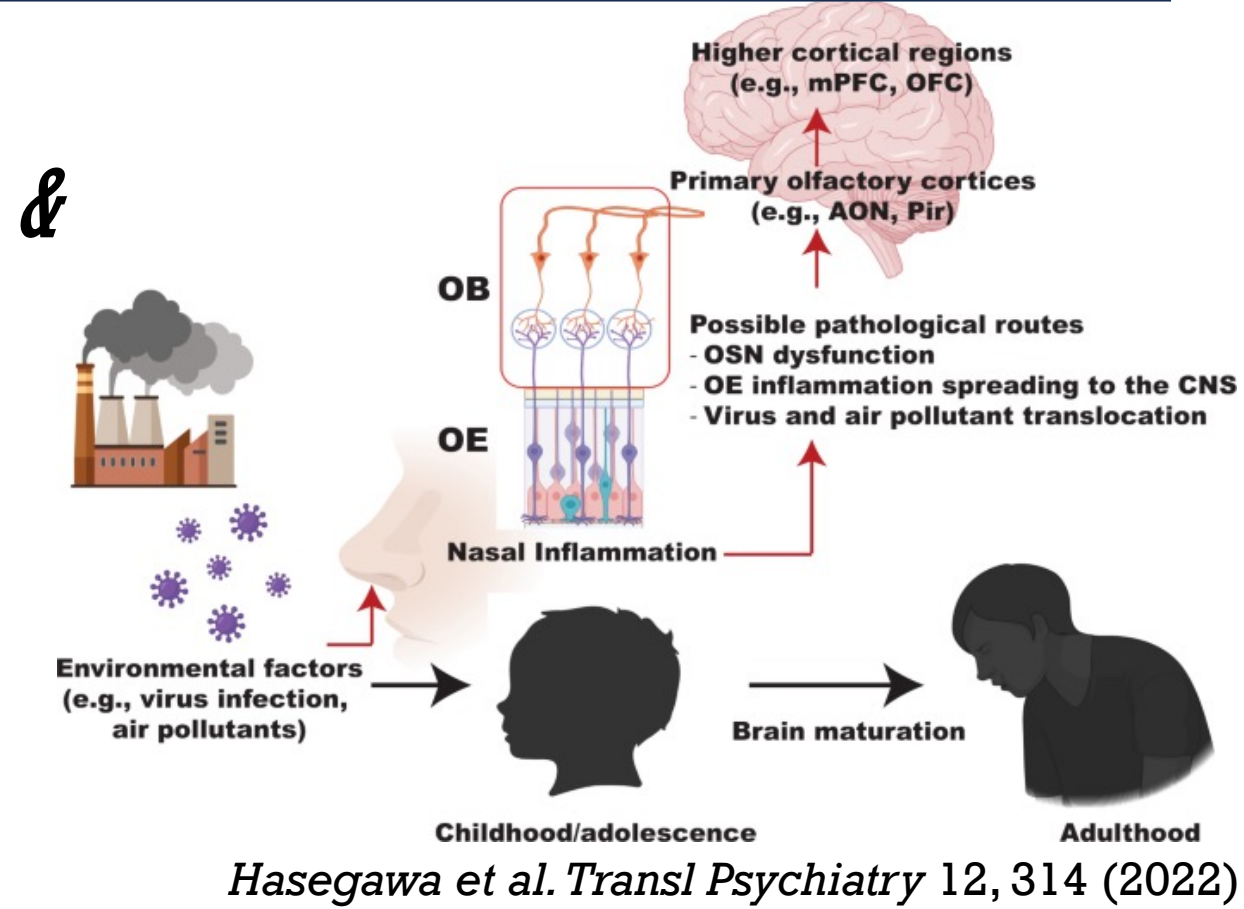


Bhattarai et al. Semin Cell Dev Biol 129, 31-39 (2022).

Disease Related to Olfactory System

Preclinical Symptom & Inflammation

Olfactory dysfunction → early potential marker for neuropsychiatric (e.g., mood disorders, ASD,) & neurodegenerative disorders (e.g., AD, PD)



Hormonal-linked disruption

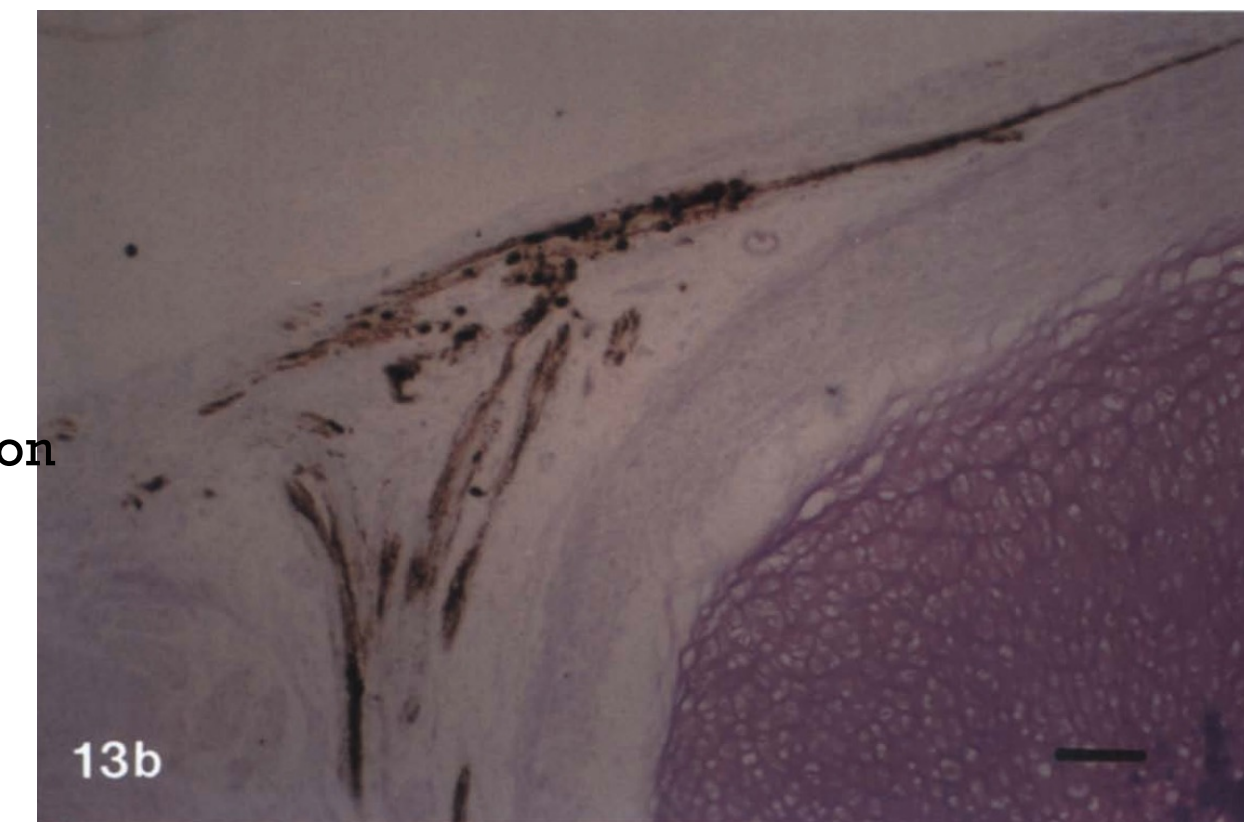
Kallmann Syndrome → olfactory system disruption leading to endocrine dysregulation

Anosmia

Could be multiple causal factors from infections, force-induced injury, olfactory groove meningioma, & more

Potential Prophylaxis?

Ketamine & TRD → seeming to alleviate mental representation of pain



Immunocytochemical & Cresyl Violet showing of GNRH neuron migratory disruption



Acknowledgments

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References



Schematic diagram showing olfactory connections throughout brain