# Chem 452 - Lecture 10
# Signal Transduction & Sensory Systems
# Part 4

**Question of the Day:** What evolutionary advantages might be derived from each of the five tastes; sweet, salty, umami (savory), bitter and sour?

## Introduction

- We rely heavily on our senses to find our place in the world…

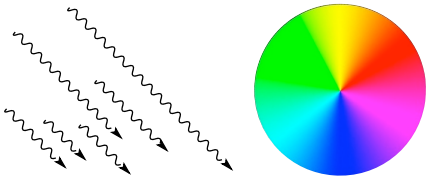


## Introduction

- … and to enjoy the world.

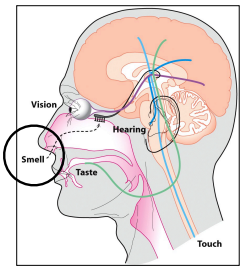

## Introduction

- Our vision provides us with both sensitivity and the ability to discern fine details.
  - We can detect as few as 10 photons of light and can also distinguish millions of colors



# Introduction

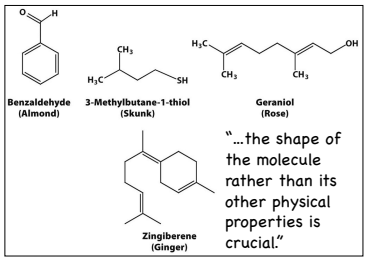
- Our senses are connected by neurons to the regions of the brain






# Olfactory (smell)

- Our olfactory sense allows us to detect small volatile molecules.

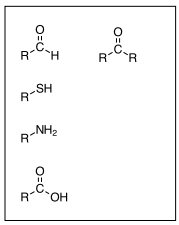



"...the shape of the molecule rather than its other physical properties is crucial."



# Olfactory (smell)

- However, specific functional groups are associated with characteristic smells



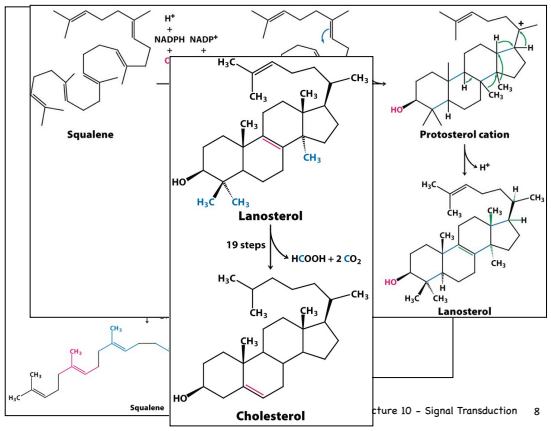
Fragrances

Rotten eggs

Fish & dead animals

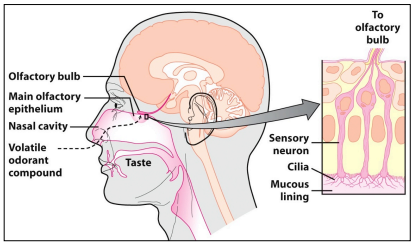
Vomit & stinky cheese





# Olfactory (smell)

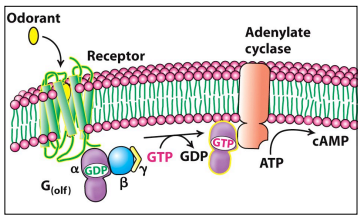
- Olfactory involves a very large family of olfactory receptors (OR) located in the nasal epithelium.






# Olfactory (smell)

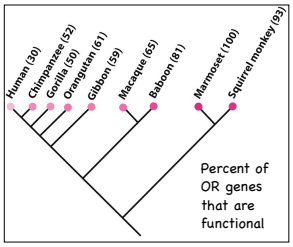
- Stimulation of these receptors was found to be associated with
  - Production of cAMP
  - The need for GTP






# Olfactory (smell)

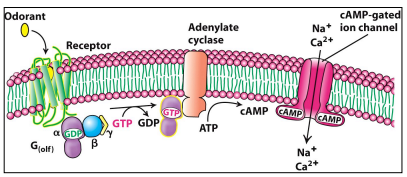
- More than 1000 OR genes are involved
  - For many organisms, many of these genes have converted to pseudogenes.






# Olfactory (smell)

- Activation of an OR receptor and the production of cAMP leads to activation of a cAMP ligand gated channel.




- This in turn, triggers an action potential

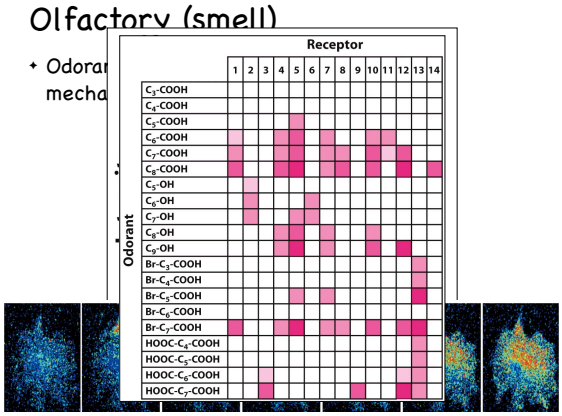
## Olfactory (smell)

- Each olfactory neuron expresses only a single OR gene!!



## Olfactory (smell)

- Odoran
  mecha



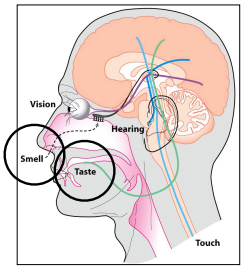

## Olfactory (smell)

- Each olfactory neuron expresses only a single OR gene!!
- Neurons that express speicif OR's are linked to specific sites in the brain.



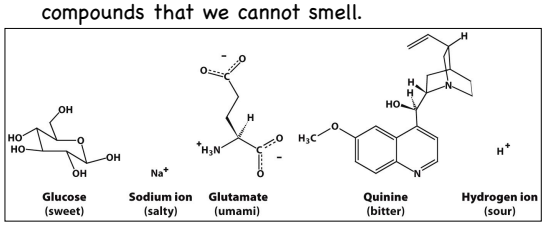
## Gustation (taste)

- Complements smell



# Gustation (taste)

- Gustation allows us to sense classes of compounds that we cannot smell.

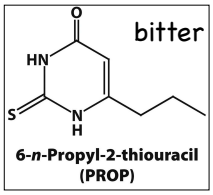



**Question of the Day:** What evolutionary advantages might be derived from each of the five tastes; sweet, salty, umami (savory), bitter and sour?



# Gustation (taste)

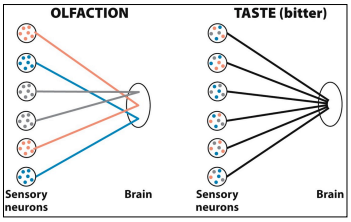
- Taste is also mediated receptors, which are found on the tongue.
  - Ability to taste PROP was mapped to chromosome 5.
  - Sequence analysis suggested involvement of 7TM receptors, named T2R receptors






# Gustation (taste)

- Unlike olfactory neurons, each taste neuron expresses an array of different taste receptors.






# Next up

- Lecture 10 con'd, Sensory Systems. (Chapter 33)