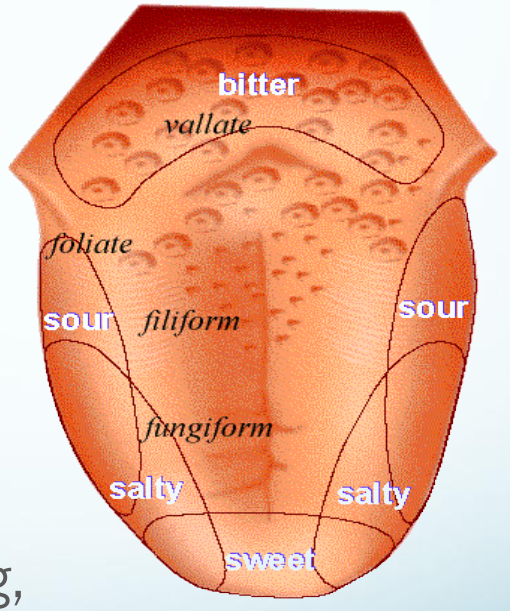
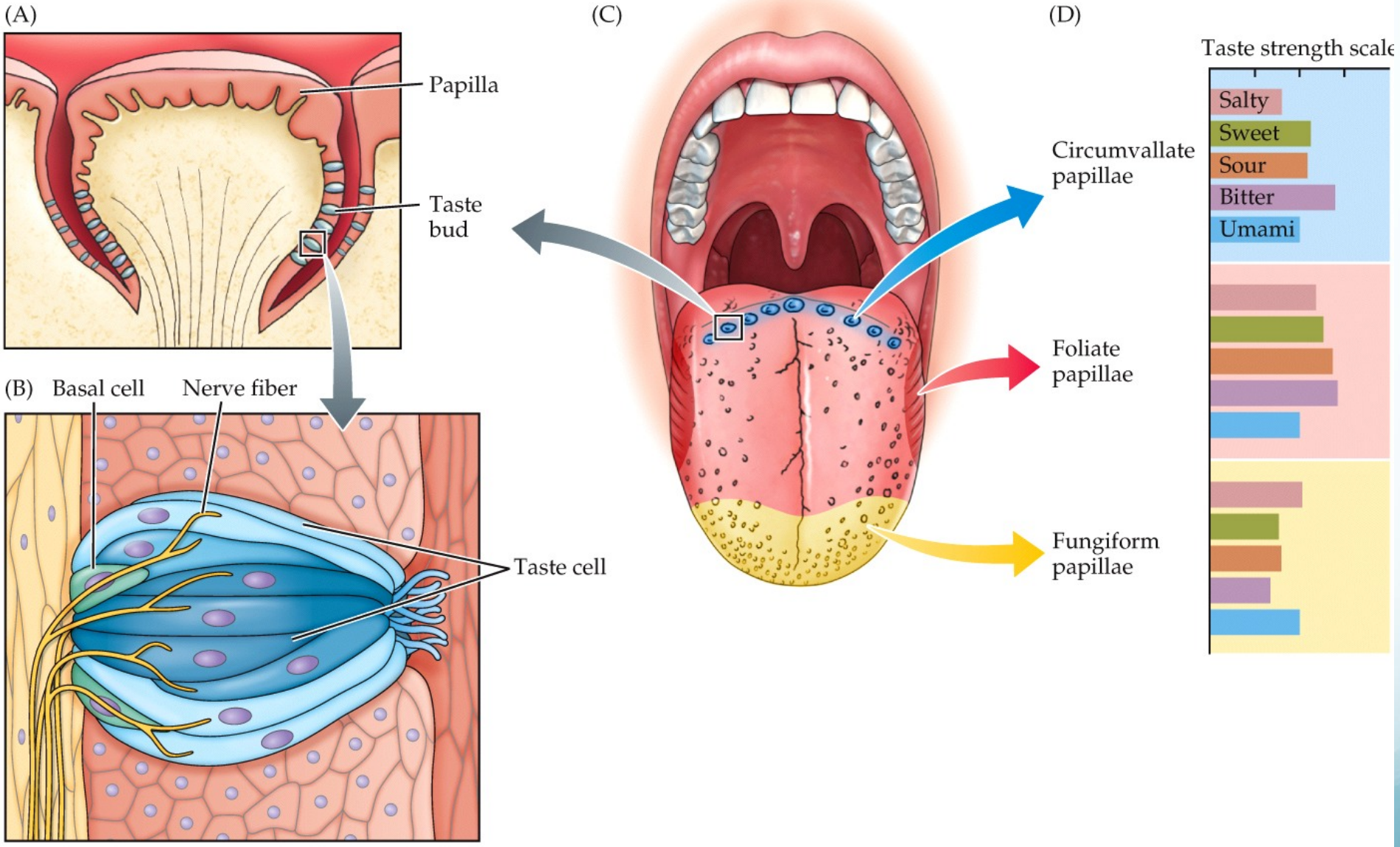
- Since 1942, tongue maps like this one were widely published and touted as an accurate portrayal of where certain taste receptors were located.
  - Wine glasses are even designed around this idea.
- The notion that the tongue is mapped into four areas—sweet, sour, salty and bitter—is wrong. **There are five basic tastes identified so far, and the entire tongue can sense all of these tastes more or less equally.**
- The tongue map is easy enough to prove wrong at home.
  - Place salt on the tip of your tongue. You'll taste salt.
  - **For reasons unknown, scientists never bothered to dispute this inconvenient truth until 1974, and even today, many textbooks still publish pictures of the tongue map.**
- Remarkably, more is known about vision and hearing, far more complicated senses, than taste.



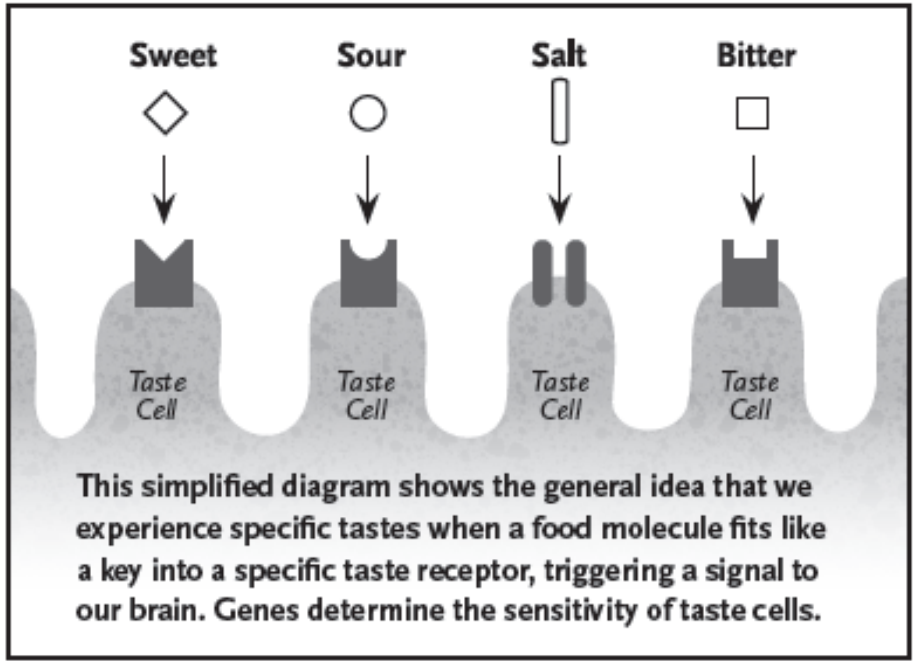
A Taste Bud and Taste Receptor Cells



***BIOLOGICAL PSYCHOLOGY 7e*, Figure 9.22**

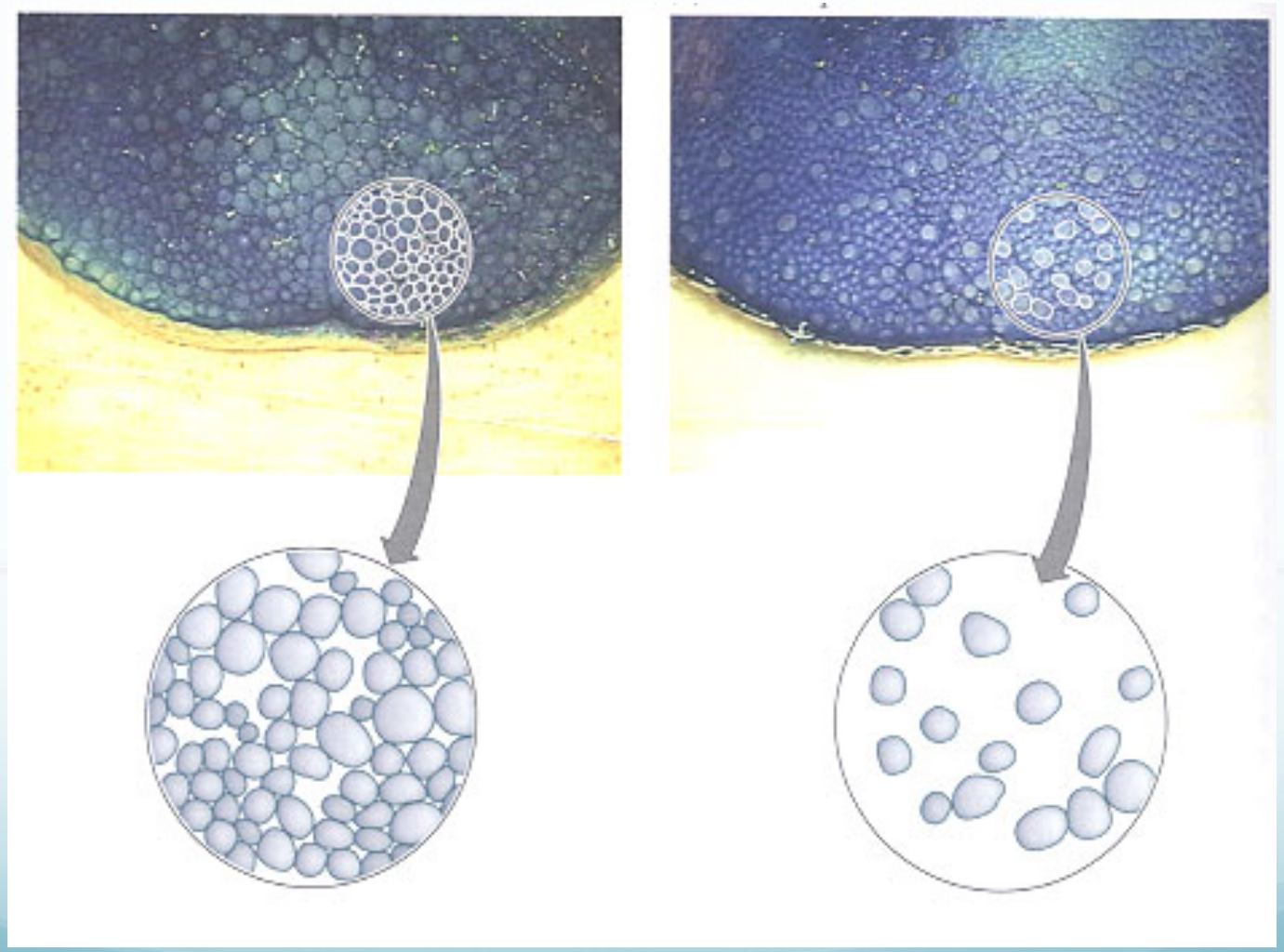
Taste Buds

- Each taste bud contains a pore that catches food
- Each taste bud pore has 50-100 taste receptor cells with antenna like hairs that sense food molecules



This simplified diagram shows the general idea that we experience specific tastes when a food molecule fits like a key into a specific taste receptor, triggering a signal to our brain. Genes determine the sensitivity of taste cells.

Individual Differences in Taste Bud Count (Fungiform Papillae)



Super-Taster Normal Taster

Taste Sensations

- Taste buds on tongue not uniform
- **Sweet receptors responds to**
  - Sugars
  - Saccharine
  - Some amino acids
- **Sour receptors…….**
  - H
  - Acids
- **Bitter receptors…….**
  - Alkaloids
- **Salty receptors……..**
  - Salt, ions, metal
- **Umami**
  - Glutamate-“Beef taste” of steak

Taste "Map" Myth Exposed (Almost)

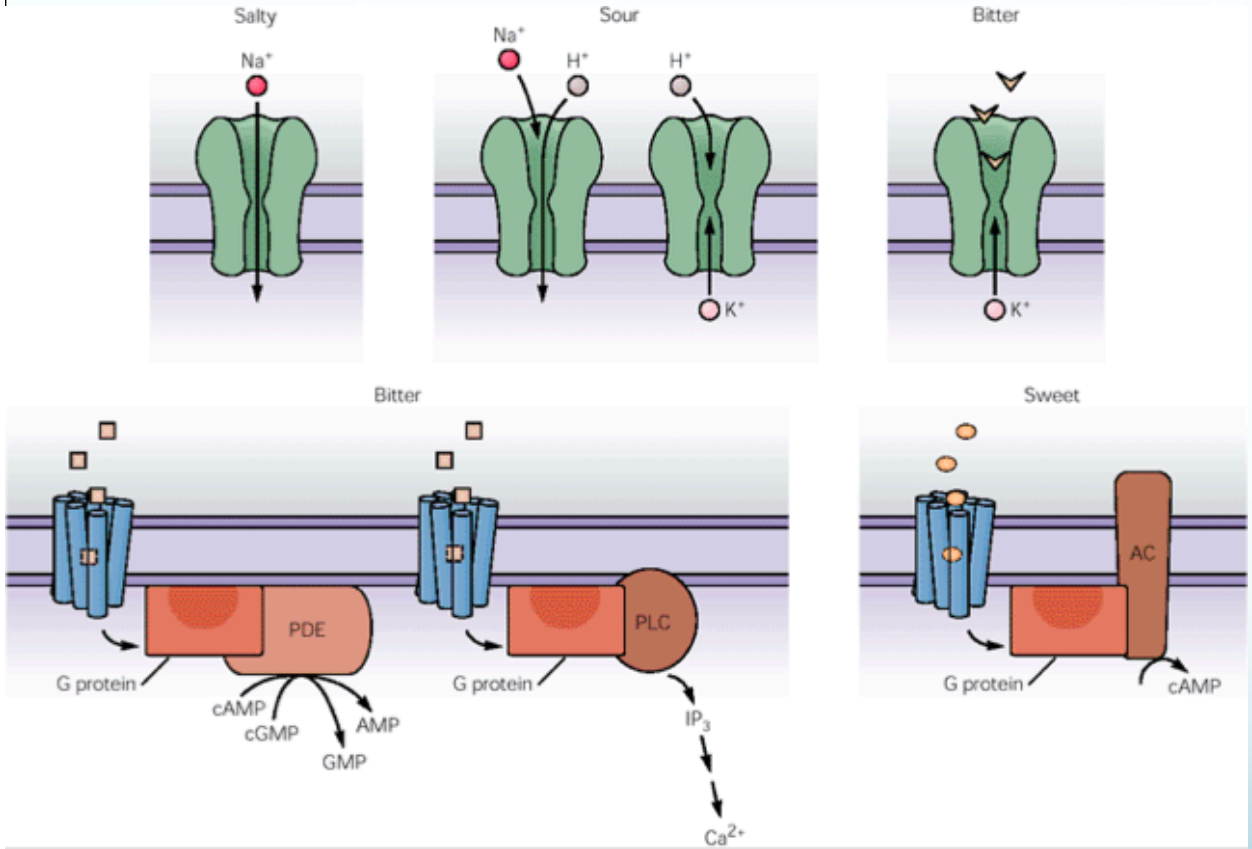
Any region of the tongue with taste buds contains taste cells that will respond to the major taste categories.

Nonetheless, regional variations in sensitivity exist:

- sweet + salty preference on anterior-third of tongue;
- bitter at the back of the tongue;
- sour along back/sides of the tongue

Five taste qualities

The gustatory system distinguishes five basic stimulus qualities: bitter, salty, sour, sweet and *umami*.



Four basic taste stimuli are transduced into electrical signals by different mechanisms.

Salty taste is mediated by Na+ influx through Na+-selective channels depolarizing the cell directly.

Sour taste can result from either the passage of H+ ions through Na+ channels or from the blockade of pH-sensitive K+ channels, which are normally open at resting potential.

Bitter, sweet and **umami** stimuli bind to G protein-coupled receptors. The common end effect of all of these mechanisms is release of Ca2+ from intracellular stores and reduction of calcium-gated K+ currents and depolarization of the cell.

Is Oleogustus the sixth taste ?

- Oleogustus "fat taste" is triggered by non-esterified fatty acids (NEFA)
  - medium and long-chain NEFA found in fats as triglycerides
    - oleic acid (olive oil)
    - linoleic acid (almonds)
    - 9-decenoic acid (palm and coconut oil)
  - have a taste sensation that is distinct from other basic tastes

- Criteria for "primary tastes," including that the sensation:
  - 1) has ecological consequence
  - 2) is elicited by a distinctive class of chemicals
  - 3) stems from activation of specialized receptors
  - 4) is detected through gustatory nerves and is processed in taste centers
  - 5) has a quality nonoverlapping with other primary qualities
  - 6) evokes a behavioral and/or physiological response

Sample Taste Detection Thresholds

(mmol concentrations in water)

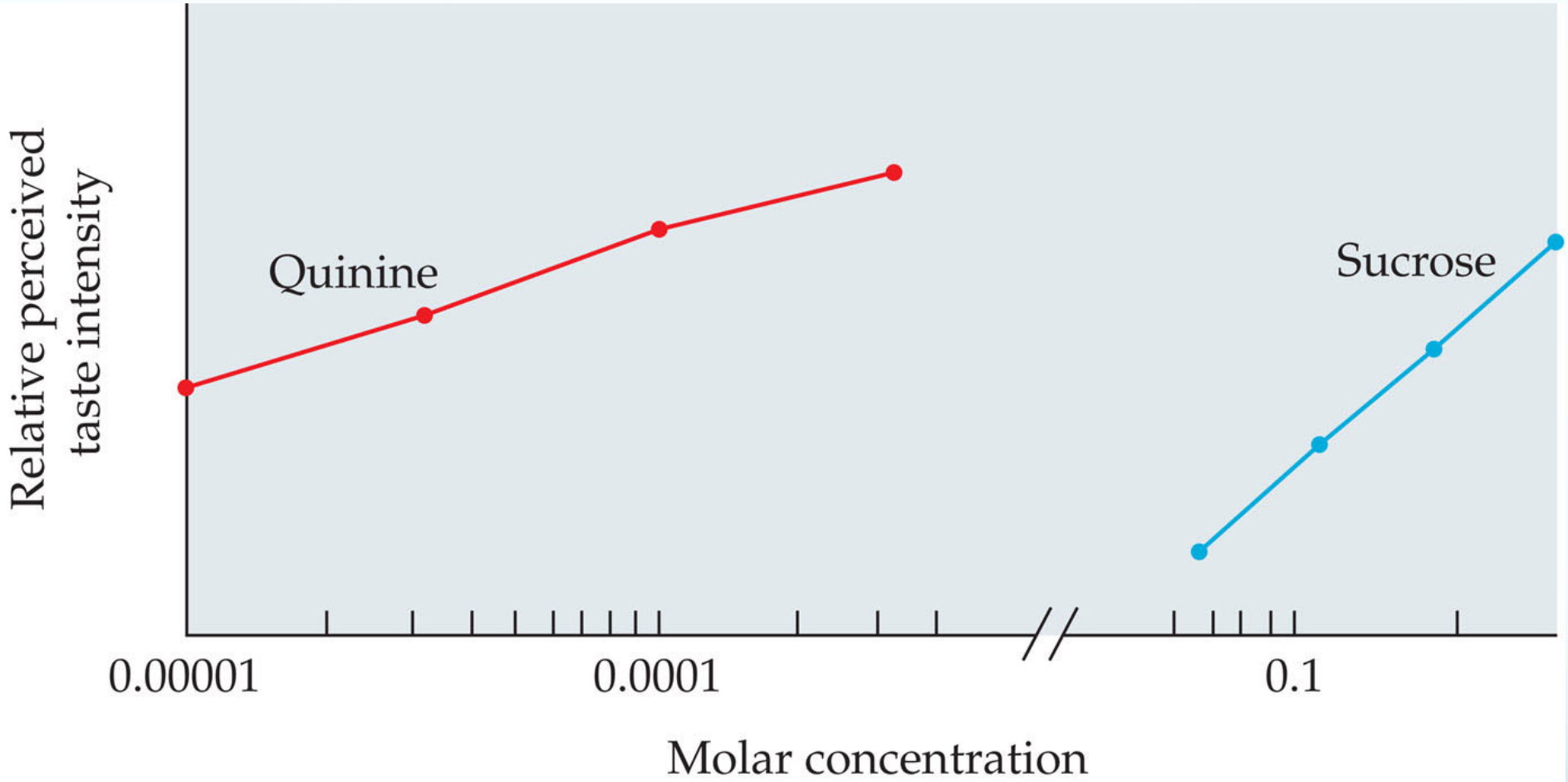
Sweet	
Saccharin	0.009
Aspartame (artificial sweetener)	0.02
Sucrose (table sugar)	0.65
Salty	
Calcium chloride	0.008
Sodium chloride	1.0
Potassium chloride	6.3
Sour	
Citric acid	0.07
Acetic acid (vinegar)	0.1
Bitter	
Quinine	0.001
Caffeine	0.05
Urea	15.0
Umami	
Monosodium glutamate	0.05

Great variation in detection thresholds both within and between categories

General Sensitivity Rule-of-thumb:
Bitter > Sour, Salty, Sweet > Umami

1 mole $C_{12}H_{22}O_{11}$ = 342 grams
0.65 mmol concentration = 0.22 g/L
(i.e., 0.03 ounce in 1 gallon)

Suprathreshold Taste Functions

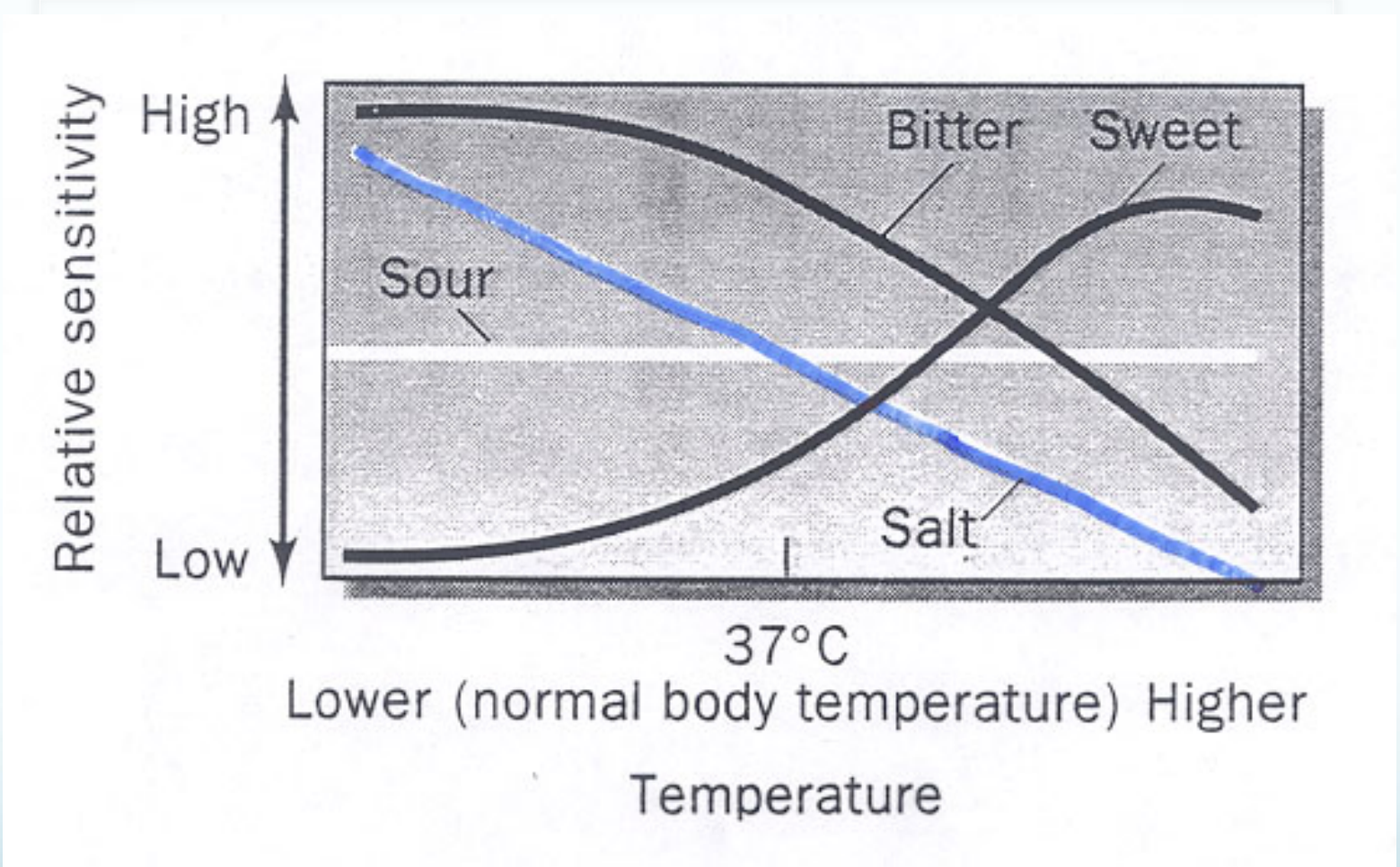


SENSATION & PERCEPTION 4e, Figure 15.11

Stevens' Law: $S = k I^n$

Taste of bitter substances grows more slowly (quinine: n=0.3) than sweetness (sucrose: n=0.8) as stimulus intensity/concentration is increased.

Temperature vs. Sensitivity

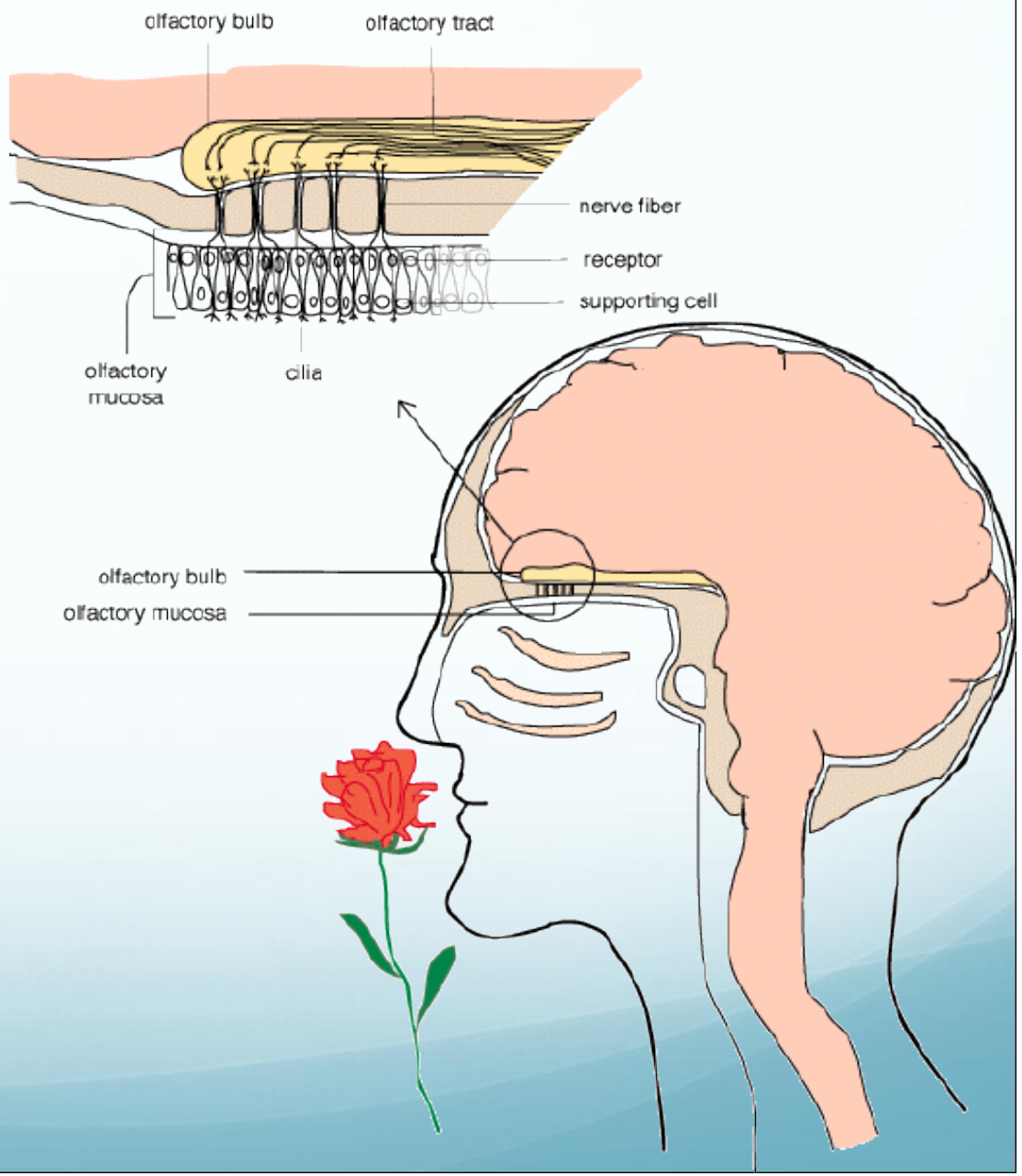


Taste Biochemistry

- The taste of salty or sour is because of the ions sodium (Na^+) for salty, hydrogen (H^+) for sour.
- They touch onto the taste receptors and immediately enter inside the cells through ion channels or pores.
- Though table salt is more than 95% sodium chloride, depending on its source, it can contain other minerals depending on its source and how crystalized.
- Iodized table salt has been treated with potassium iodide and may also include aluminum, calcium, magnesium carbonate and silicon dioxide.

Mastication releases gases

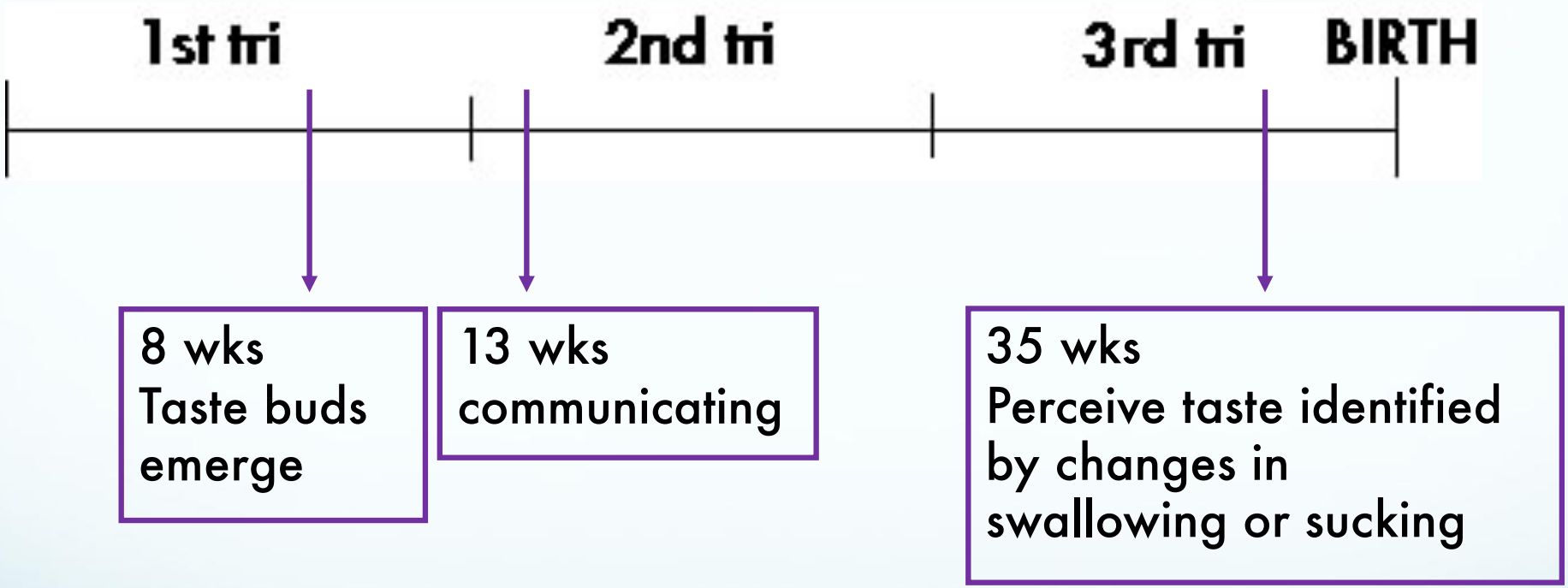
- Thin layer of nerve cells called olfactory epithelium receives gases and transduces them into smell signals
- Brain combines smells signals with simple taste signals and decides if its something you want to eat.



Aroma & memory

- Nerve signals for smell go right past parts of our brain associated with memory.
  - Smelling salts (ammonium carbonate can wake you up by causing an inhalation reflex
  - Smells can bring back memories
  - Comfort foods
  - McD's makes billions on this (Happy Meals)

Taste Development



- At birth the ability to taste is fully developed
- There is an increase in the number of taste buds