

Taste and Smell

- Both taste and smell are chemical senses.
- They give us information about the chemical composition of our surroundings.
- Smell is a more distant sense allowing us to detect small concentrations of airborne substances.
- Taste is an immediate sense - a final checkpoint for the acceptability of food before it enters the body.

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Taste and smell only separated when animals moved to land

- Since in the sea, all chemicals are dissolved in the same medium (water) there is no need for two separate senses.
- Fish and other sea creatures have one general chemical sense.
- Taste is not just in the mouth
 - Examples: catfish have chemoreceptors all along their body (a catfish is like a giant tongue); flies have receptors on their feet so that they can tell immediately upon landing whether an object is good to eat.

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Separate systems for smell and taste

- OLFACTION

- Molecules in air
- Lipid-soluble, volatile
- Locating food, mates, places, etc.

- GUSTATION

- Molecules in solids and liquids
- Water-soluble
- Testing food, drink, etc. before ingesting.

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Chemoreception is closely related to basic motivational drives (the so-called four “Fs”)

Feeding

Drinking

Sex

Emotion



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Chemoreception is closely related to memory

Memories of tastes and smells are some of the most persistent and evocative of all sensory memories.



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Taste

- Why do we need taste?
 - Taste is a gate-keeper sensory mechanism designed to test food and other substances before they enter the body.
 - Things that are potentially useful for the body tend to taste good, and things that are potentially harmful taste bad.

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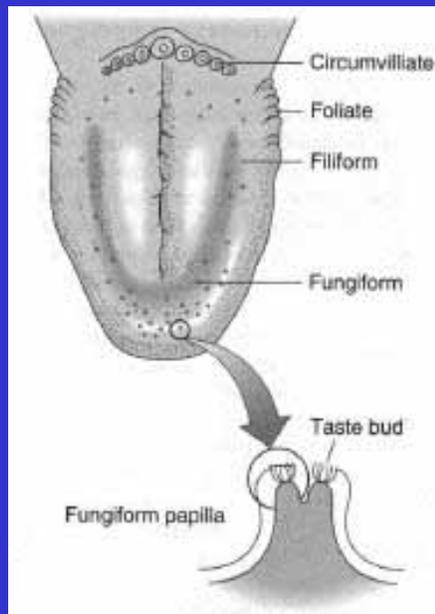
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Anatomy of Taste

- The tongue contains many ridges and valleys called papillae.
- There are four types of papillae:
 - **Filiform papillae:**
 - cone shaped & found all over the tongue (which is why tongues look rough) .
 - **Fungiform papillae:**
 - mushroom shaped & found at the tip and sides of the tongue
 - **Foliate papillae:**
 - a series of folds along the sides of the tongue
 - **Circumvallate papillae:**
 - shaped like flat mounds surrounded by a trench & found at the back of the tongue

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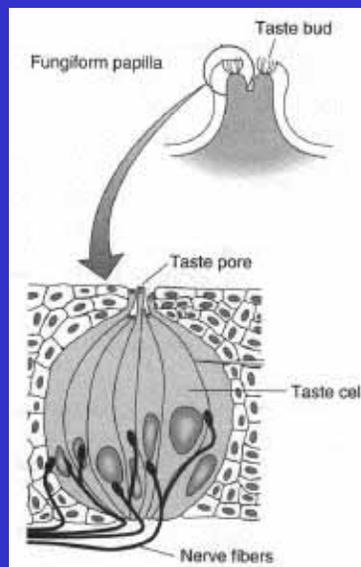
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Tongue

- All papillae except filiform contain taste buds (so the very center of your tongue which only has filiform papillae is "taste-blind").
- Each taste bud contains a number of taste cells which have tips that protrude into the taste pore.

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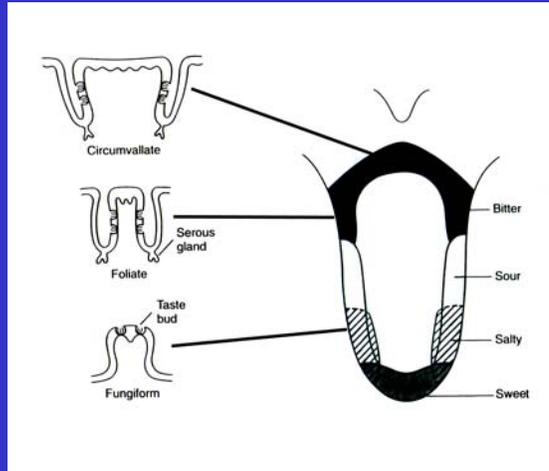


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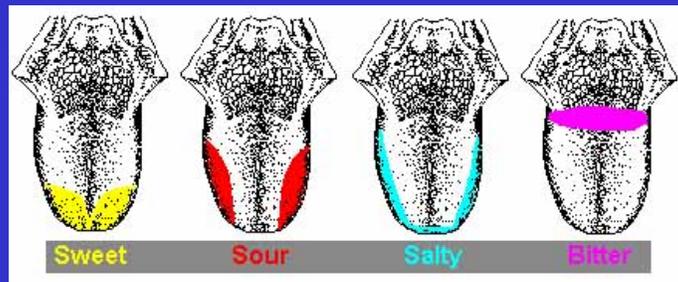
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Different types of papillae are located on different parts of the tongue.

This observation has contributed to the theory (not entirely correct) that different parts of the tongue are specific to different taste qualities.



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The Four Basic Tastes (cont'd)

- Salty:
 - Salt made up of two particles: Cation, anion
 - Ability to perceive salt: not static
 - Liking for saltiness is not static
 - Gestational experiences may affect liking for saltiness

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The Four Basic Tastes (cont'd)

- Sour:
 - Acidic substances
 - At high concentrations, acids will damage both external and internal body tissues

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The Four Basic Tastes (cont'd)

- Bitter:
 - Quinine: Prototypically bitter-tasting substance
 - Cannot distinguish between tastes of different bitter compounds
 - Many bitter substances are poisonous
 - Ability to “turn off” bitter sensations—beneficial to liking certain vegetables
 - Heightened sensitivity early in pregnancy

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The Four Basic Tastes (cont'd)

- Sweet:
 - Evoked by sugars
 - Many different sugars that taste sweet
 - Appetite and artificial sweeteners

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The Four Basic Tastes (cont'd)

- The special case of umami:
 - Candidate for fifth basic taste
 - Monosodium glutamate (MSG)
 - Glutamate: important neurotransmitter
 - Safety issues in human consumption

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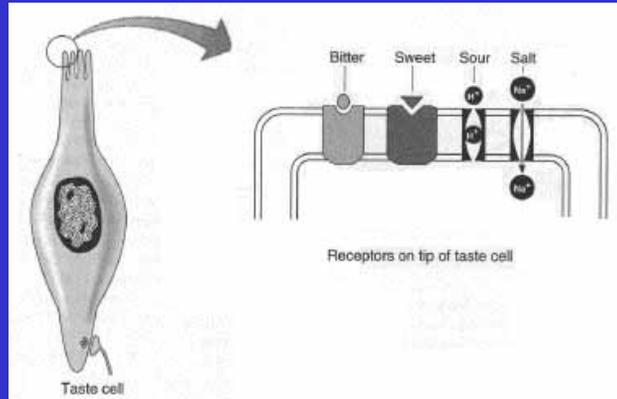
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The Taste Pathway

- Transduction occurs when different taste substances cause a change in the flow of ions across the membrane of a taste cell.
- Different substances affect the membrane in different ways.
 - Bitter and sweet substances bind into receptor sites which release other substances into the cell.
 - Sour substances contain H⁺ (hydrogen) ions that block channels in the membrane.
 - Salty substances break up into Na⁺ (sodium) ions which flow through the membrane directly into the cell.

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The Neural Code for Taste

- What tastes do we taste?
 - The four basic tastes are sour, sweet, salty, and bitter.
 - All of our taste sensations can be described as a combination of these four basic tastes.
- Different taste receptors (and therefore different parts of the tongue) are most sensitive to different tastes.

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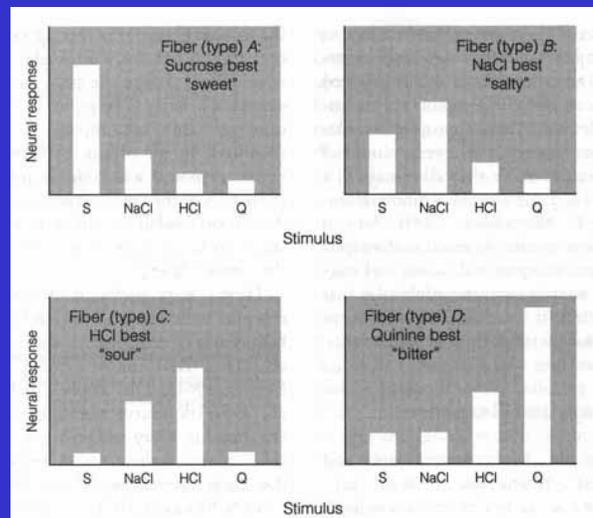
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Specificity vs. Distributed Encoding for Taste

- Specificity encoding:
 - There are fiber tracts that are responsible for a specific taste sensation (e.g., there is a "salty" tract, or a "sweet" tract).
- Distributed encoding:
 - A taste sensation is the result of a pattern of activation of the different taste cells. Substances that cause similar patterns of activation will taste similar.

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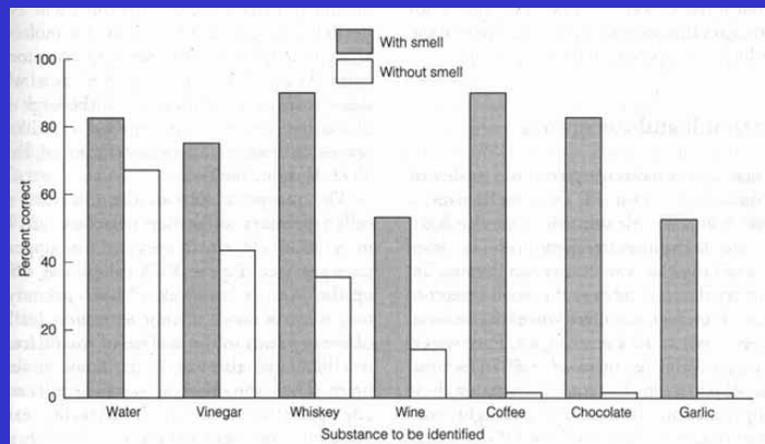
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Experience of Taste

- Your experience of taste depends on:
 - your internal state (things always taste better when you're hungry),
 - on your past experiences (familiar foods generally taste better than unfamiliar foods),
 - and your genes (people have different sensitivities to certain tastes).
- Taste experience is also subject to effects of adaptation
 - Why does orange juice taste gross after you've just brushed your teeth?
- Our sensation of taste also depends heavily on smell and texture (touch).
 - Ever notice how food just doesn't taste that good when you have a stuffed up nose?

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Taste versus Flavor

- Retronasal olfactory sensations: Flavor
 - Taste and smell woven together
 - Flavor impoverished with stuffy nose