Taste

PSY 310

Greg Francis

Lecture 36

Why toothpaste ruins your orange juice.

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Taste

- Perceptual awareness of the molecular properties of items that go through the mouth
- Last line of defense for preventing unwanted chemicals from entering the body
- Identification of needed nutrients
- A part of a more complex perception known as *flavor*
  - Combination of taste, smell, temperature, texture, consistency
- We'll briefly look at the physiology of taste and the perceptual representation of taste information
- We'll also briefly look at flavor
- There is much that is simply unknown

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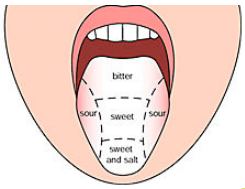
Stimulus

- Similar to olfaction, the stimulus is a molecule
- It must be soluble in water (saliva)
  - A plastic spoon and a metal spoon generally taste the same (no taste) because no parts are carried by saliva to the taste receptors
- Different shapes of molecules activate different receptors on the tongue
- You often see an image like this in *Health* books
  - It is incorrect
- Taste receptors are all over the tongue (and other areas of the vocal tract)
- It is true that different areas of the tongue have varying sensitivity to tastes



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Tongue

- Covered with little bumps called papillae

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Tongue

- The large, bright red parts of this blown up picture of the surface of the tongue are the papillae
- There are actually four kinds of papillae
  - They are located at different places on the tongue
  - All but one contains taste buds

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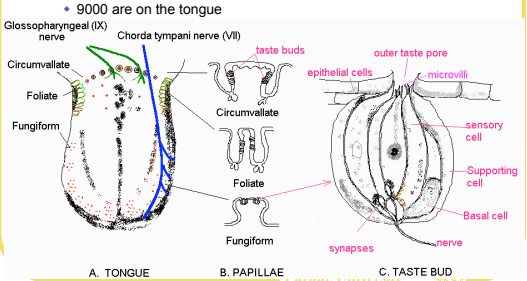
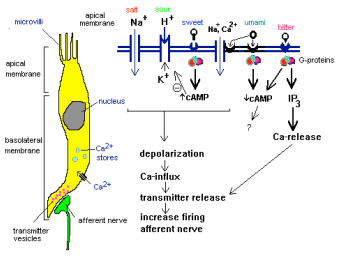
Taste buds

- Taste buds are garlic-shaped sets of cells with receptors that are sensitive to some molecules
- There are approximately 10,000 taste buds
  - 9000 are on the tongue



Taste buds

- Each taste bud contains 50-100 taste cells that have receptors sensitive to different kinds of molecules
- There are five types of receptors that can change the behavior of a taste cell



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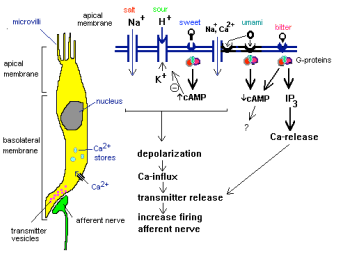
Taste cells

- An individual taste cell usually contains more than one type of receptor
- An exception is that a taste cell does not simultaneously have receptors for sweet and bitter
- Usually, a taste cell contains more of one receptor type than another



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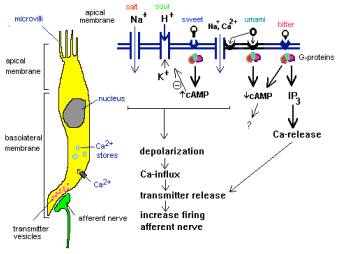
Taste cells

- Activation of different receptors do different things to the taste cell
- It is not entirely clear whether the neural response is different for different receptor activations
- Taste cells are regenerated about every 10 days



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Taste qualities

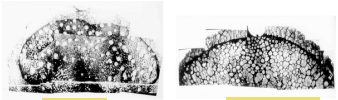
- There are five basic taste qualities, which correspond to different receptors
  - Salty: sodium chloride (table salt)
  - Sour: e.g., hydrochloric acid
  - Sweet: e.g., sucrose (table sugar)
  - Bitter: e.g., quinine (in tonic water)
  - Umami: glutamate acid (monosodium glutamate, MSG), corresponds to a "meaty" taste
- The receptors have varying sensitivities

Examples of some human thresholds

Taste	Substance	Threshold for tasting
Salty	NaCl	0.01 M
Sour	HCl	0.0009 M
Sweet	Sucrose	0.01 M
Bitter	Quinine	0.000008 M
Umami	Glutamate	0.0007 M

Individual differences

- There is quite a bit of variability in taste buds across people
- Some people (about 25% of the population) are supertasters
  - They are especially sensitive to a certain chemical that we register as bitter (phenylthiocaramide, PTC)
- Some people (about 25% of the population) are nontasters
  - They do not register PTC at all
- The rest of us can taste PTC, but don't find it especially bitter
- It appears to be related to the number of papillae on the tongue
  - Supertasters have more



regular supertaster

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Orange juice and toothpaste

- Orange juice is usually sweet
- If you brush your teeth before drinking it, orange juice tastes bitter
- Chemicals can do more than just activate taste receptors
- A compound common to toothpaste is *sodium lauryl sulfate*
  - It is a kind of detergent
  - It temporarily suppresses the sweet receptors, so the bitter parts of orange juice (citric acid) dominate the taste

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Miracle fruit

- There is also a plant native to West Africa that interacts with taste receptors
- After eating the berries, sour foods taste sweet
- How it does this is unknown, but it changes the responses of neural fibers
- Fibers that usually respond to sweet things will respond to sour things
- Lasts about an hour

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Taste mixtures

- Usually we do not ingest a single kind of chemical
- Most foods contain many different chemicals that are mixed together
- It is possible to mask one taste with another
  - Taste suppression: add sugar to coffee to mask the bitterness of the coffee
- In vision a mixture of two colors can lead to an entirely different perceptual experience
  - Red and green lights look yellow
- In audition a mixture of two tones does not lead to a new perceptual experience
  - Two tones played together sounds like two tones

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Taste mixtures

- Taste is more complicated
- Lemon juice with sugar can taste both sour and sweet
  - It never tastes salty
  - This is more like audition, where individual tastes remain
- At the same time, some combinations of stimuli produce unexpected tastes
- Part of the problem is that variability across people make it difficult to compare responses from different people
- Moreover, most people are more aware of flavor than taste

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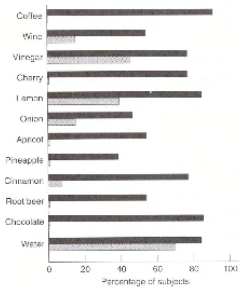
Flavor

- Our judgments of food flavor depends on
  - Taste, olfaction, texture, temperature, and other factors
- Smell is particularly important for flavor
- More subjects can identify a flavor with nostrils open than closed



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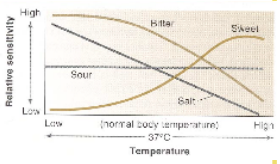
Flavor

- Temperature also influences perceived taste
  - Sensitivity to bitterness is lowest at high temperatures
  - The opposite for sweetness
- In fact, temperature can induce a taste all by itself
  - An increase in temperature from 20 to 35 degrees C produces a sensation of sweetness
  - A drop in temperature from 35 to 20 degrees C produces a sensation of sour or salty



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Conclusions

- Taste involves receptors on the tongue
- Neural code for taste is largely unknown
- Flavor involves more than just taste

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Next time

- Review for final exam

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