

Sensation and Perception

- **Sensation**: Immediate response of the body to stimulation of sensory organs
- **Perception**: Selection, organization, and interpretation of sensory input

Sensation

Immediate Response of the Body
to Stimulation of Sensory Organs

Basic Question

- Where does human knowledge come from? Where and how do we obtain the knowledge that we have about the world around us?
- This is an old question and attempts to answer this question can be traced throughout just about every area of psychology

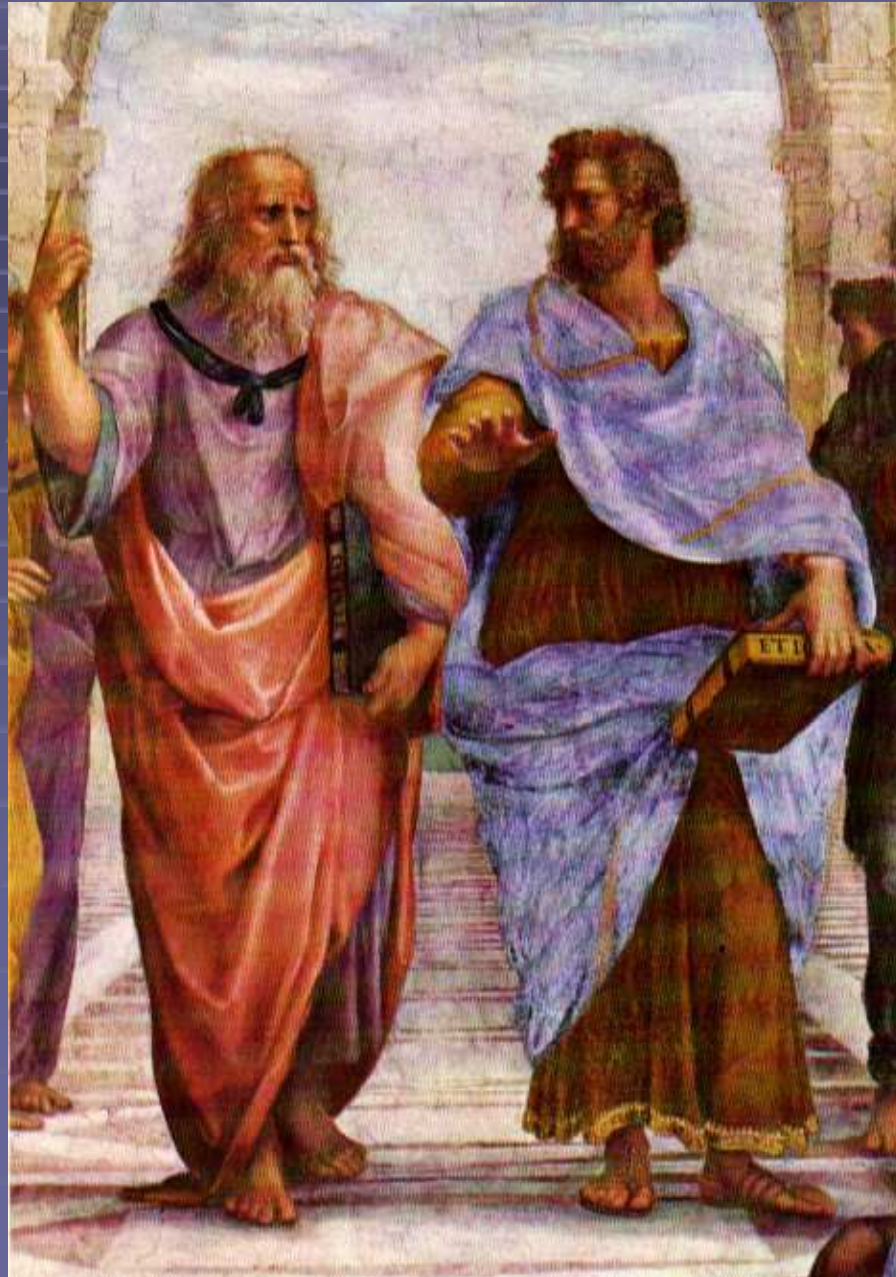
Two Basic Answers

- **Empiricism** (Aristotle, Locke, Berkeley, Hume)
 - Knowledge comes from sensory input alone
 - The mind is a *tabula rasa*
 - All knowledge comes *solely* from experience. Individual differences among people due almost entirely to differences in past experiences they have had
 - Nurture end of Nature – Nurture continuum
- **Nativism** or Rationalism (Plato, Kant, others)
 - Knowledge cannot come from sensory input alone
 - When organism perceives the world it imposes built-in categories or structures on the data to organize the information into meaningful knowledge
 - Kant argued for *a priori* categories such as time, space, causality
 - Nature end of Nature – Nurture continuum

The School of Athens by Raphael



Plato and Aristotle



J.B. Watson's Boast

“Give me a dozen healthy infants, well-formed, and my own specified world to bring them up in and I’ll guarantee to take any one at random and train him to become any type of specialist I might select—doctor, lawyer, artist, merchant-chief, and, yes, even beggar-man thief—regardless of his talents, penchants, tendencies, abilities, vocations, and race of his ancestors”

Examples of Nature-Nurture Controversy in a Variety of Areas

- Laws of learning the same for all species or species-specific?
- Piaget's structural cognitive developmentalism (built-in structures)
- Skinner-Chomsky controversy over the nature of language development
- Inheritance of abilities, personality traits, psychopathology, etc.
- Are there built-in predispositions toward aggression, love, etc. in animals, humans?

Important Distinction

Answering the question, “How does information get in, and exactly *what* gets in?” requires a basic distinction between *distal* and *proximal* stimuli

- ***Distal stimulus***: Actual object or event (often at a distance), e.g., actual building
- ***Proximal stimulus***: Pattern of energies that actually impinge on organism, e.g., light patterns (visual image) of building on the retina

Notes

- Note that the proximal stimulus does not possess the same qualities (e.g., size, distance, depth) as the distal stimulus. We don't know the *thing-in-itself*; we can only know characteristics of the stimulus energies that impinge on the organism.
- The primitive experiences these stimulus energies create in the organism are called *sensations*, e.g., loudness of tone, sweetness of taste, color

Empiricist Analysis

- According to empiricists, all knowledge is ultimately composed only of sensations
- How do organisms use those sensations to infer things about how to survive?
- Through *association*: Perceptual world becomes organized through experience with the world, and that experience creates associations among sensations
- Empiricists point to evidence that emphasizes the role of *experience* in organizing perceptions

Colin Turnbull's Description

The tropical forests in which the BaMbuti Pygmies live are so dense that the natives can rarely see for more than a few yards in any direction. Under such circumstances they have come to rely largely upon sound cues to guide their hunting. Rarely is it necessary to make perceptual judgments based upon visual cues of distance or depth discrimination . . . When one of the Pygmies, Kenge by name, traveled with Turnbull to an open plain where the view was unobstructed, nature (or nurture?) suddenly began playing tricks on him. Turnbull reports:

“Kenge looked over the plains and down to where a herd of about a hundred buffalo were grazing some miles away. He asked me what kind of *insects* they were, and I told him they were buffalo, twice as big as the forest buffalo known to him. He laughed loudly and told me not to tell such stupid stories, and asked me again what kind of insects they were. He then talked to himself, for want of more intelligent company, and tried to liken the buffalo to the various beetles and ants with which he was familiar.”

“He was still doing this when we got into the car and drove down to where the animals were grazing. He watched them getting larger and larger, and though he was as courageous as any Pygmy, he moved over and sat close to me and muttered that it was witchcraft. . . Finally when he realized that they were real buffalo he was no longer afraid, but what puzzled him still was why they had been so small, and whether they *really* had been small and had suddenly grown larger, or whether it had been some kind of trickery.

(From Ruch & Zimbardo, p. 277)

Psychophysics

The Study of Sensations

- One of the oldest and most distinguished areas of psychology
- Study of the relation between physical characteristics of the stimulus and the psychological (subjective) experience that results therefrom
- Gustav Fechner (1801-1887) is often called the 'Father of psychophysics'

Fechner's Work

- Interested primarily in *intensity of sensation* as a function of *physical intensity*
- Argued that sensations can't be directly compared with physical stimulus intensities; nonetheless they can be directly compared with one another
- Subject can compare two of his own sensations and decide whether they are the same or different, or whether one is more intense than another

Thresholds

- The **absolute threshold** is the lowest physical intensity of a stimulus that a person is able to detect
 - Ex. How loud does a tone have to be for a subject to be able to detect that a tone has sounded?
- The **difference threshold** or just-noticeable-difference (*JND*) is the difference in physical intensity between two stimuli that is required before a person will be just barely able to detect the difference
 - Ex. By how much do two tones have to differ in loudness before a subject can tell they differ?

Typical Absolute Thresholds

Vision	Candle at 30 miles on a dark, clear night
Hearing	Tick of a watch at 20 feet
Taste	Teaspoon of sugar in 2 gallons of water
Smell	Drop of perfume in a 3-room apartment
Touch	Wing of a fly falling on your cheek from a distance of 1/2 inch.

JND's and Weber's Law

- The JND (difference threshold) is measured in physical units, but is a measure of the individual's subjective ability to discriminate
- Fechner wanted to use difference thresholds to obtain a scale of subjective sensation and relied on the work of Weber (1795-1878)
- Weber's Law: The size of the JND is a constant fraction of the initial stimulus throughout the range of stimuli:

$$\frac{\Delta I}{I} = K$$

Examples of Weber's Law

- Fechner and his followers did a huge number of studies to see if Weber's Law held for all sense modalities
- The constant K is different for different modalities but the law holds pretty well over large intensity ranges of most modalities; it does break down at extremes

Typical Weber Fractions

Continuum

Weber Fraction

Brightness

1/60

Loudness

1/20

Heaviness

1/40

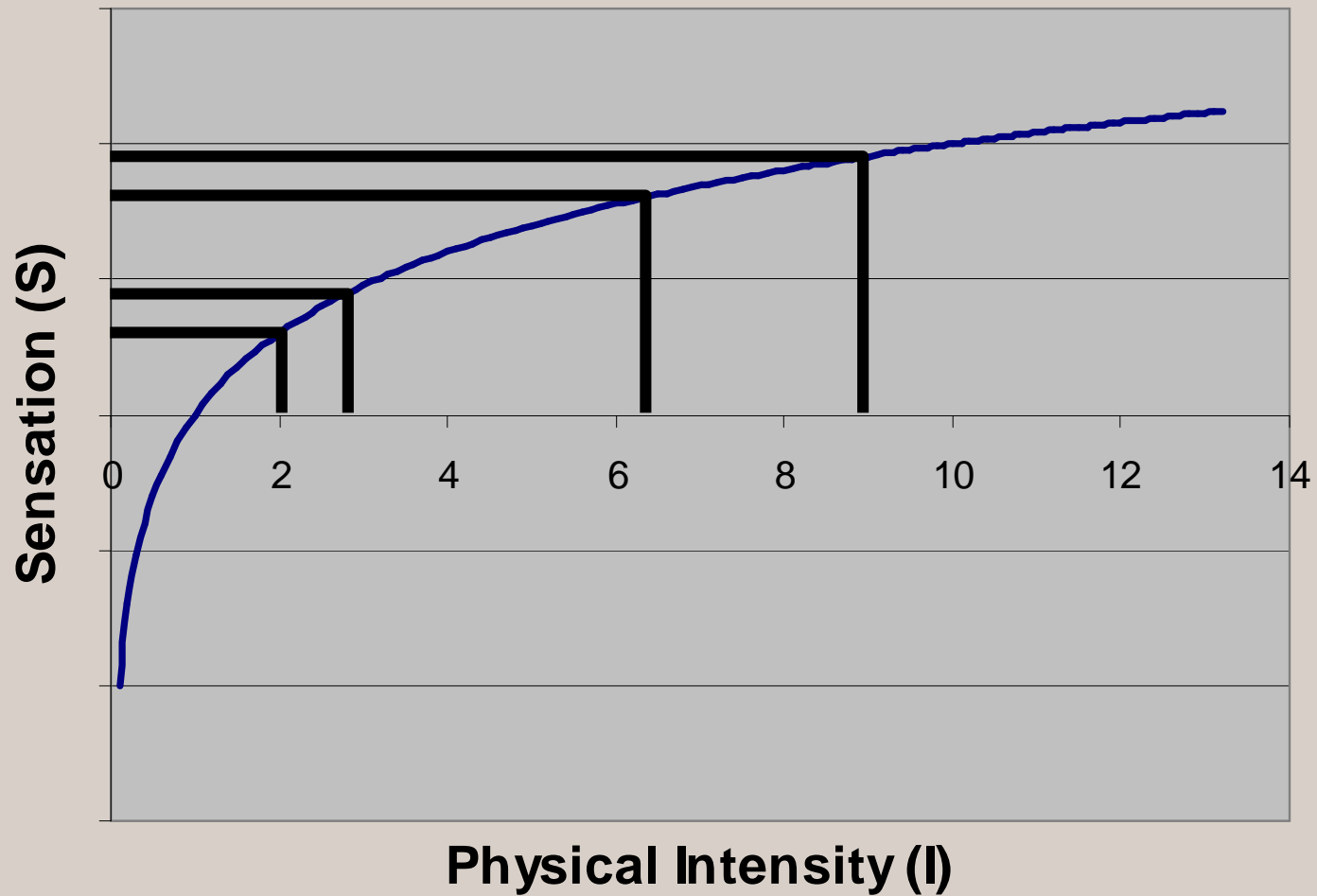
- Example: If one can just barely detect the difference between a 41 oz. weight and a standard 40 oz. comparison weight, it would require a difference of 2 oz. for one to detect a difference when the standard comparison weight is 80 oz.

Fechner's Law

- Fechner took Weber's Law and added the assumption that the JND was the *subjective unit* of sensation to come up with a scale for sensation
- That is, the *subjective* difference between two stimuli 1 JND apart on one part of the stimulus range is the same as the *subjective* difference between two stimuli 1 JND apart on a very different part of the stimulus range, even though the *physical intensity* differences aren't the same
- This led to Fechner's Law: $S = K \log (I)$
- Where S is subjective sensation, I is physical intensity, and K is the Weber fraction

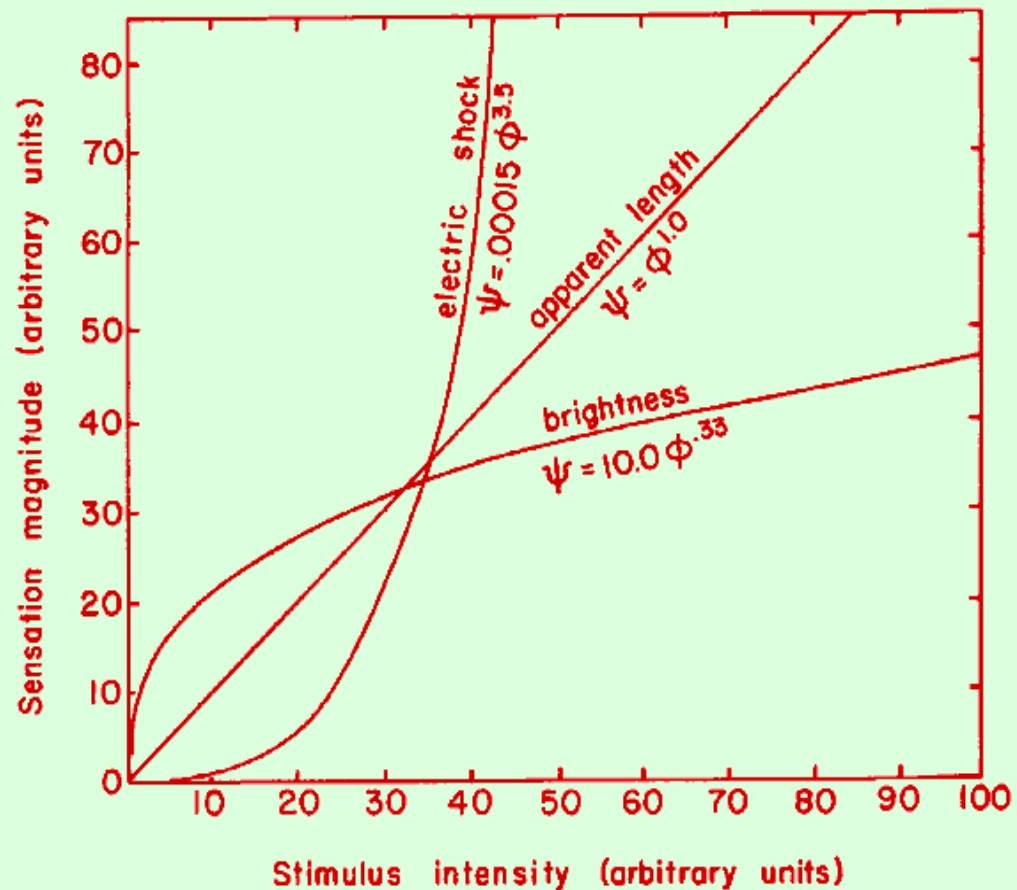
Fechner's Law

$$S = K \log (I)$$



Stevens' Power Law

- A major alternative to Fechner's Law is Stevens' Power Law, $S = a I^K$, where a and K are constants that vary from modality to modality
- Leads to functions like those in the figure to the right
- More widely accepted now than Fechner's Law



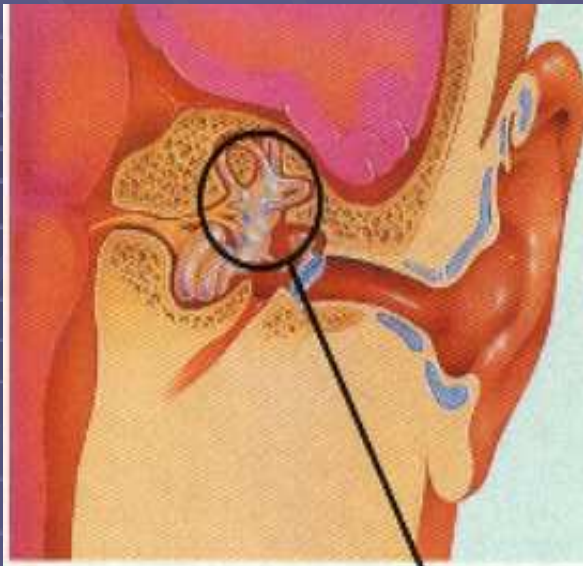
Human Senses

- Kinesthesia and vestibular senses
- Taste
- Skin senses
- Smell (olfaction)
- Hearing (audition)
- Vision

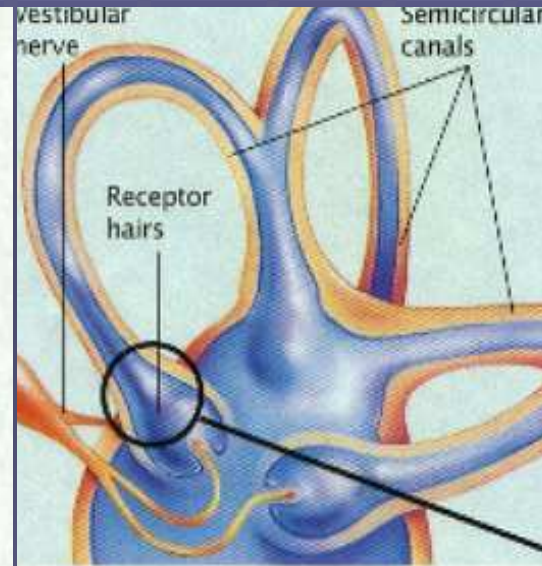
Kinesthetic and Vestibular Senses

- Provide information to the person about body movements and orientation in space
- Receptors in muscles, joints, etc. for kinesthesia
- Receptors in inner ear (vestibules, semicircular canals) for spatial orientation

Vestibular Sense

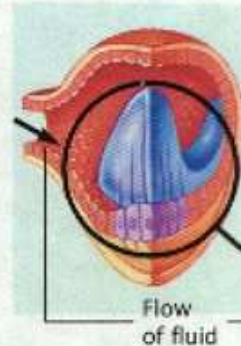


a The semicircular canals are three looped rings in the inner ear.

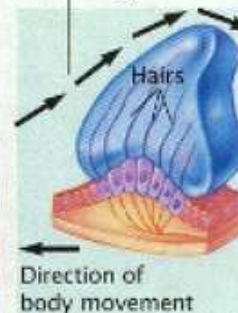
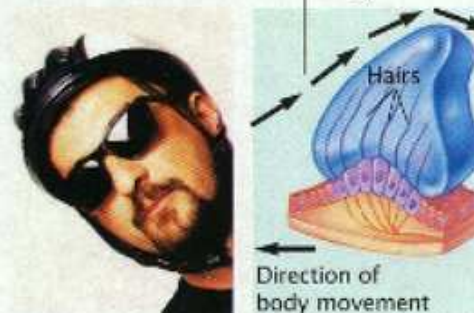


b Each canal has a swelling at one end, which is lined with receptor cells inside. Tiny hairs protrude from the receptor cells into a jellylike fluid.

c When your head is upright, the fluid is still and the hairs are upright.



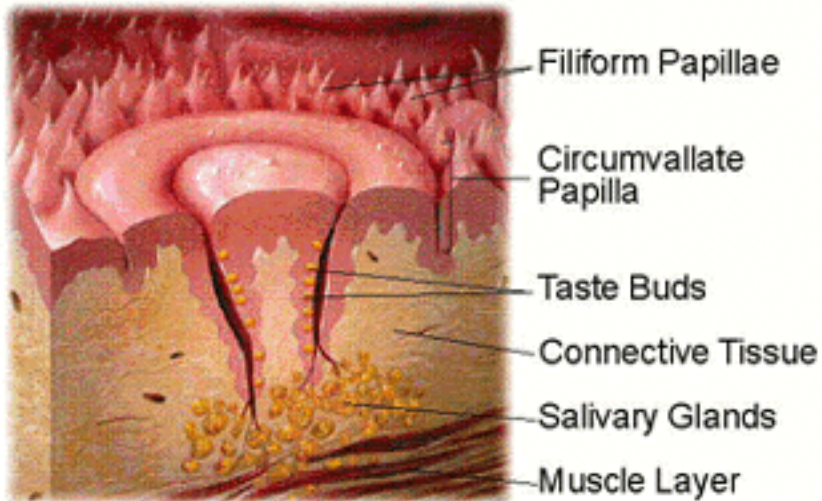
d Any movement causes the fluid to slide over the hairs and bend them in the opposite direction. The hair cells send messages to the brain about your position in space.



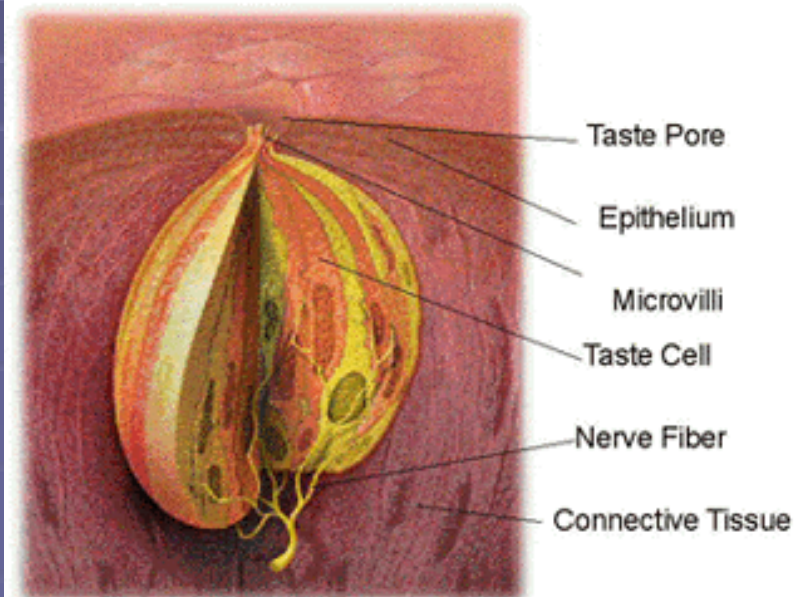
Taste

- Taste receptors (taste buds) respond to chemicals in the mouth
- Five basic kinds of sensation: sweet, bitter, sour, salty, and umami (glutamate) that every taste bud responds to
- Scattered throughout the tongue; *not* separate tastes in different areas of the tongue

Circumvallate Papilla

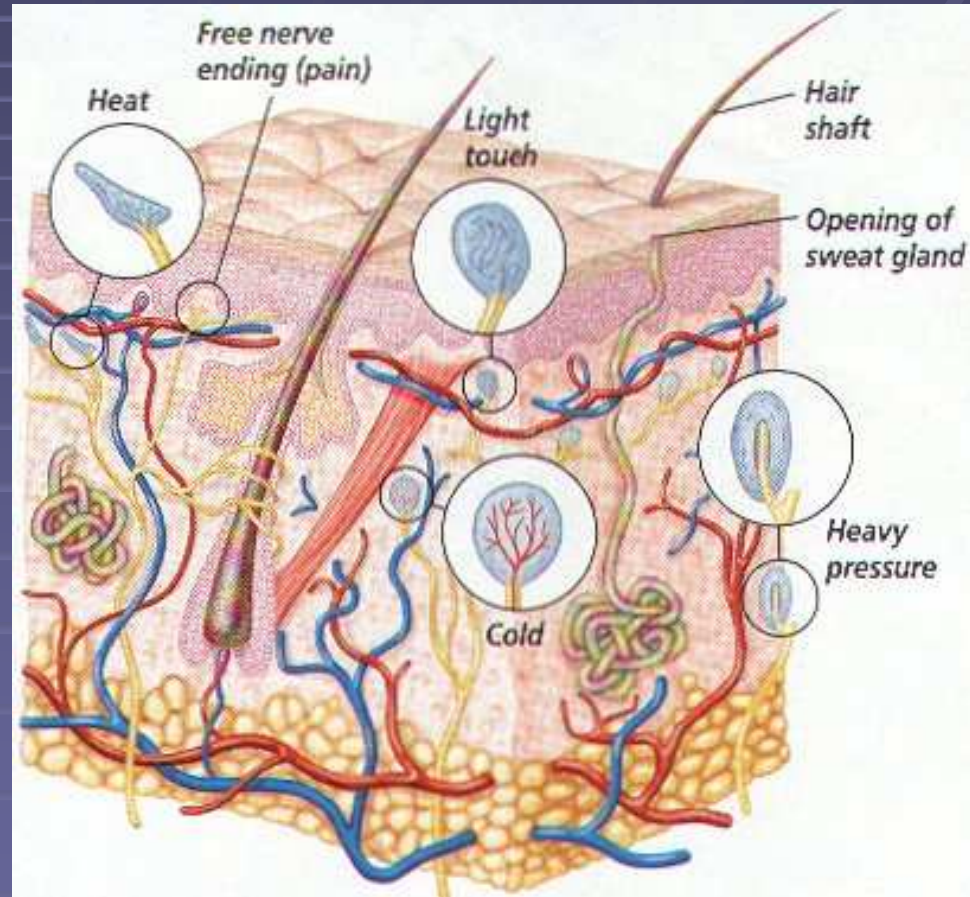


Taste Bud



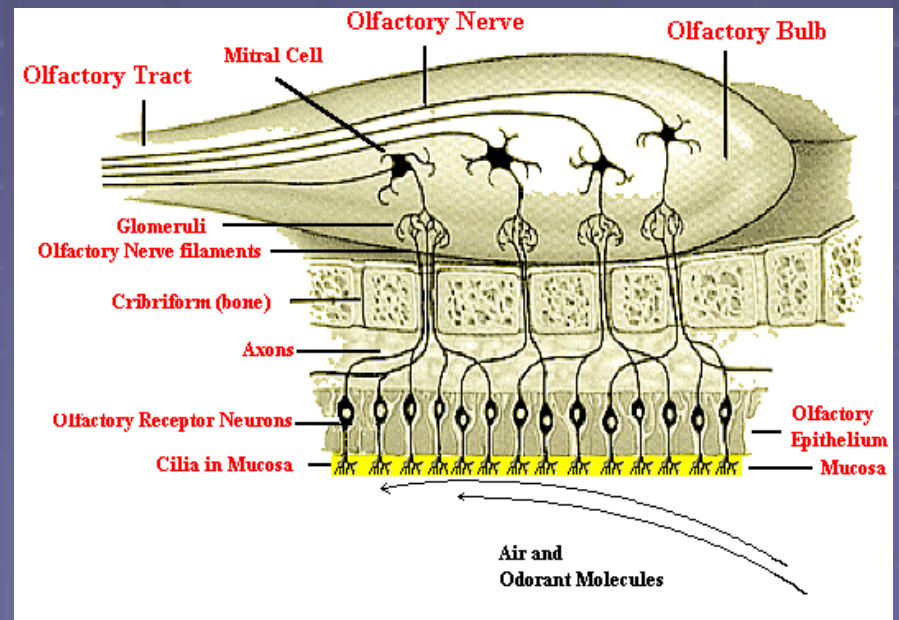
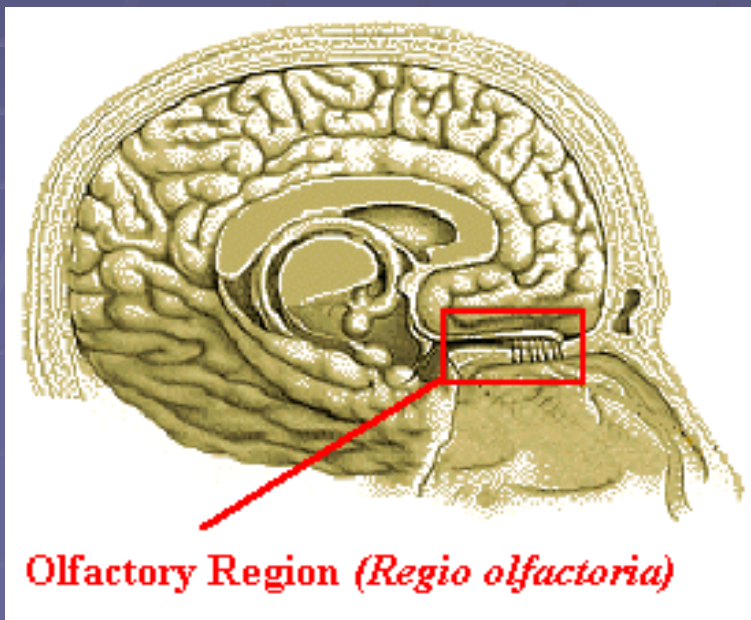
Skin Senses

- Skin has several different types of sensory receptors just below the surface of the skin
- Heat, cold, light touch, heavy pressure, pain



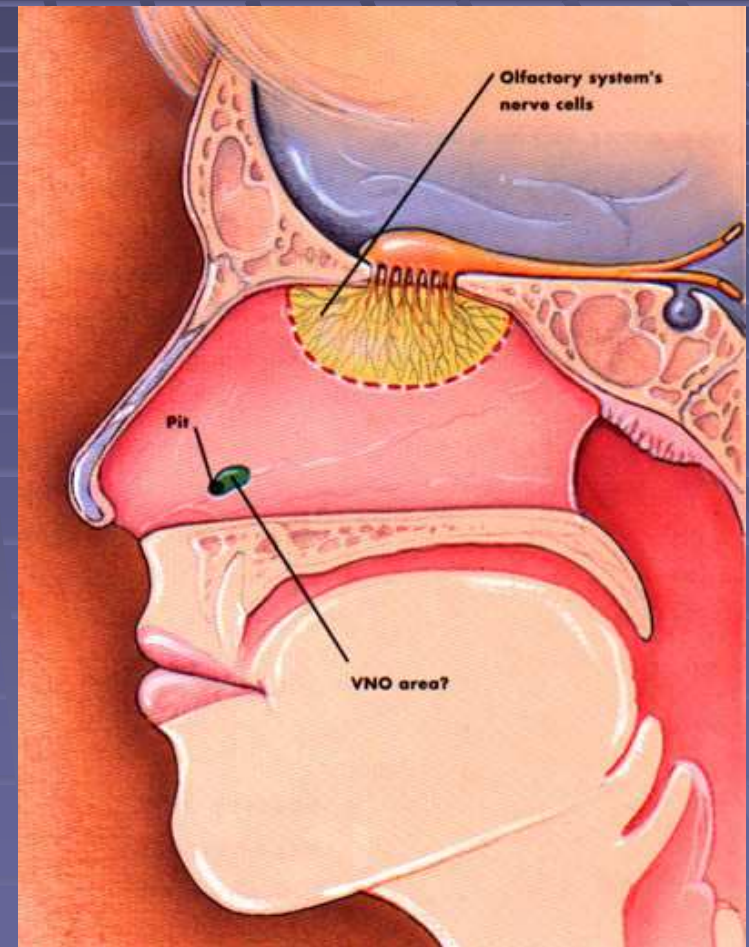
Olfaction (Smell)

- Senses chemicals suspended in air
- Not as important in humans as in many animals
- Over 1000 different types of receptor
- Women and young adults typically have higher sensitivity



Pheromones

- Airborne chemicals that have a strong effect on behavior (usually reproductive) in many organisms
- Receptors in vomeronasal organ (VNO)
- Unclear whether humans have a working VNO but recent evidence indicates humans respond to certain chemicals in underarm sweat in ways that suggest they may be pheromones



Hearing (Audition)

- Ear senses mechanical pressure of sound waves, amplifies it mechanically, then transduces energy to electrical nerve impulse

