Chapter 7 (pg. 231-246)

1. **Identify the terms *sensory receptors*, *sensory neurons*, and *sensory areas*. How are these implicated *in transduction*, *sensory coding*, and *sensory adaptation*?**

Sensory Receptor: specialized structures that respond to physical stimuli by producing charges that initiate neural impulses in the sensory neurons.

- in some senses the receptors are sensitive ends of sensory neurons (touch) and in others they are separate cells that form synapses upon sensory neurons. (rods/comes of retina of eye).
- They can all exist in a specific, localized sensory organ (eye, nose) or spread out over wide variety of locations (pain receptor in skin and muscles)

Sensory Neurons: the specialized neurons that carry info from sensory receptors to the central nervous system. These lead to specific pathways in the central nervous system that are unique to each sense.

Sensory Areas: Areas of the cerebral cortex where sensory neurons send their messages (occipital: vision).

- Conscious sensory experience depends on activity in the cerebral cortex (opposed to unconscious behavioral reactions to sensory stimuli from lower brain structures, like flinching).

Transduction: the process by which a receptor cell produces an electrical charge in response to physical stimulation (how receptors in ear respond to sound)

- Membrane of receptor cell becomes more permeable to certain electrically charged particles, such as sodium or potassium ions, when the appropriate type of stimulus energy acts on the receptor cell (this is how sensory receptors respond to stimuli)
- The electrically charged particles flow through the membrane and change the electrical charge across the membrane (RECEPTOR POTENTIAL) which is just like postsynaptic potential produced by the action of synaptic transmitters
- Receptor potential then triggers events that lead to production of action potentials in axons of sensory neurons.

Sensory Coding: the preservation of relevant information about the physical stimuli to which a specific sense is responding.

- Every form of energy varies along two dimensions, Transduction occurs in a way that info about the quantity and quality of the stimulus is preserved in the pattern of action potentials send to the brain.
    - Quantitative variation: involves amount or intensity of energy
        - Coding: stronger stimuli produce larger receptor potentials, which produce faster rates of action potentials in sensory neurons.
    - Qualitative variation: involves precise kind of energy (lights of different wavelengths are perceived as different colors, sounds of different frequencies)

- Coding: qualitatively different stimuli optimally activate different sets of neurons. (Different receptors within any given sensory tissue respond best to somewhat different forms of energy).
    - Ex. Eye has three different kinds of receptor cells that are each most sensitive to a different range of wavelengths of light and provide basis of color vision.
    - Ex. Sugar/ Salt, both receptors on tongue respond to sugar/ and salt but certain ones respond with more neural impulses per second to salt than to sugar. These are the receptors more optimally activated for sugar. No matter which receptor quantity still produces more action potentials than before.

Sensory Adaptation: The change in sensitivity that occurs when a given set of sensory receptors and neurons is either strongly stimulated or relatively un-stimulated for a length of time.

- Our senses are designed to alert us to changes in our sensory environment and to be relatively oblivious to steady states
- When amount of stimulation increases for period of time, the sensory system adapts by becoming less sensitive, when amount of stimulation decreases for a period of time, sensory system adapts by becoming less sensitive.
    - Ex. when you get into pool its cold but after awhile its cool.
- Sensory adaptation can be mediated by sensory cells themselves and also mediated partly by changes in the central nervous system (sensory areas)
    - Initially stimulated, high receptor potential and rate of action potentials, but other time they become much reduced, resulting in reduced sensation.
    - Sensory adaptation also mediated by changes in sensory areas central nervous system.
        - Ex. plug one nostril w/ nail polish near it. After change and plug other. Still kind of adapted.

2. **What evidence is there that humans can identify others by smell? How does smell play a role in mother-infant bonding and choosing a genetically compatible mate? Do humans communicate using *pheromones*?**

Evidence that humans can identify others by smell:

Experiment: One set of subjects wear initially clean T-shirt for a day w/o washing or using deodorants or perfumes, and then other subjects are asked to identify by smell alone which shirt had been worn by whom.

- Results: Parents can tell which of their children wore the shirt, children can tell which of their siblings wore it, and people can distinguish between odors of two strangers.

Role of Smell in Mother-Infant Bonding:

- Mothers and infants quickly learn to recognize each other's smell.
- Studies:
    - 90% of mothers who had been exposed to their newborn for just 10 to 60 minutes after birth were able to identify a shirt worn by their child by smell alone.
    - Breast-fed babies as young as 6 days old reliably turned their heads towards cotton pads that their own mothers had worn against their breasts, when given choice between that and identical pad of different lactating women.
    - Odor plays a role, but is not essential

Role of Smell in Choosing a Compatible Mate:

- Mice: prefer to mate with opposite-sex mice whose odor is most different from their own
    - Individual scent results from a set of about 50 highly variable genes (called **MHC**)
    - MHC genes also determine type of cells used in disease-fighting aspect of immune system. (MHC genes structure the immune system)
    - By choosing mates that smell most different from themselves the mice :
        - Mates are not likely to be close relatives
        - Mates that add genetic variation to the mix of disease fighting cells that develop in the offspring.
- MHC also in humans, contributes to individual odor differences, so presumably same advantages apply to humans in choosing mates with opposite scent.
    - Study: young men/women asked to smell shirts and rate scents according to "sexiness"
        - Any given donor's odor was on average rated more pleasant by raters who differed fro that person in MHC
    - Women's sexual desire may be more influenced by MHC than men's because of need to find good mate for offspring since less chances to make babies.

Do Humans Communicate Using Pheromones?

- Pheromone: chemical substance that is released by an animal and acts on other members of its species to promote some specific behavioral or psychological response
    - Humans have structures that make pheromone communication possible
        - Specialized glands in skin that secrete odorous substances
            - Esp. in areas w/ more hair
    - Humans do not need or appear to have sex-attractant pheromones

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3. **What is the *gate-control theory* of pain and what are some stimuli that cause an increase in pain sensitivity? What are some neural and chemical mechanisms that result in pain reduction?**