Olfactory Physiology (cont’d)

- The feel of scent:
  - Odorants can stimulate somatosensory system through polymodal nociceptors (touch, pain, temperature receptors)
  - Cranial nerve I = olfactory receptors
  - Cranial nerve V (trigeminal nerve) = somatosensory receptors
  - Often impossible to distinguish between sensations from cranial nerve I from and those traveling up cranial nerve V

From Chemicals to Smells

- Theories of olfactory perception:
  - Shape-pattern theory
    - Match between shapes of odorants and odor receptors
  - More recent molecular research
    - Scents are detected by means of combinatorial codes
  - Vibration theory
    - There is a different vibrational frequency for every perceived smell
    - Molecules that produce same vibrational frequencies will produce same smell

Specific anosmia (cont’d)

- The inability to smell one specific compound with otherwise normal smell perception
- 50% of population has specific anosmia to androstenone
- Change in detection can occur with training
- This cannot be explained by vibration theory

Study of stereoisomers:

- Molecules that are mirror-image rotations of one another; although they contain the same atoms, they can smell completely different
- Vibration theory cannot explain this phenomenon
From Chemicals to Smells (cont’d)

- The importance of patterns:
  - How can we detect so many different scents if our genes only code for about 1000 olfactory receptors?
  - We can detect the pattern of activity across various receptor types
  - Intensity of odorant also changes which receptors will be activated
  - So weak concentrations of odorant do not smell the same as strong concentrations of it
  - Specific time order is important

Hypothetical Role of OR Receptor Activation

From Chemicals to Smells (cont’d)

- Odor mixtures:
  - We rarely smell “pure odorants,” rather we smell mixtures
  - How do we process the components in an odorant mixture?
  - Two possibilities:
    1. Analysis
    2. Synthesis

From Chemicals to Smells (cont’d)

- Analysis: Example from auditory mixtures
  - high note and low note
- Synthesis: Example from color mixtures
  - mixing red and green lights, resulting in yellow light

Synthesis

From Chemicals to Smells (cont’d)

- Odor imagery:
  - Humans have little or no ability to conjure odor “images”
  - We do not think in smell, do not imagine smells
Olfactory Psychophysics, Identification, and Adaptation

• Detection, discrimination, and recognition
  – How much stimulation is required before we perceive something to be there?
  – Olfactory detection thresholds: Depend on several factors

Olfactory Psychophysics, Identification, and Adaptation

– Women: Generally lower thresholds than men, especially during ovulatory period of menstrual cycles, but their sensitivity is not heightened during pregnancy
– Professionals can distinguish up to 100,000 odors (e.g., professional perfumers, wine tasters)
– Durability: Our recognition of smells is durable even after several days, month, or year

Odor Recognition Retention

• Identification:
  – Attaching verbal label to smell is not easy
  – “Tip-of-the-nose phenomenon”
  – Compare to “tip-of-the-tongue” phenomenon
  – Anthropologists found that there are fewer words for experience of smells as opposed to other sensations

Olfactory Psychophysics, Identification, and Adaptation (cont’d)

• Sense of smell and language
  – Disconnected, possibly because…
    • Olfactory information is not integrated in thalamus prior to processing in cortex
    • Majority of olfactory processing occurs in right side of brain while language processing occurs in left side of brain