The "Special Senses," Special Testing, and the Occupational Health Practitioner

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Topics to be covered:

- Distinction between general & special senses
- Review of occupational disorders of the special senses
- Distinction between electrophysiology & psychophysical testing
- Review of psychophysical tests in the special senses

Disclosures: None
Definition of “General Senses”

- “…the general senses are perceived [through] receptors scattered throughout the body… rather than tied to a specific [organ]”
  - Mechanoreception
    - Touch / Pressure / Vibration / Proprioception
  - Thermoreception
  - Chemoreception
    - Exogenous & endogenous agents
  - Nociception

Definition of “Special Senses”

- “…the special senses are the senses that have specialized organs devoted to them”
  - Vision
  - Hearing
  - Vestibular function
  - Olfaction
  - Taste

Both general and special sensory systems employ specialized cell structures
Cr. N’s. & Special Senses

Sensory Modality vs. Causal Agent

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<tr>
<th></th>
<th>Physical</th>
<th>Chemical</th>
<th>Biological</th>
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<tbody>
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<td>Vision</td>
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Electrophysiology vs. Psychophysics

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<tr>
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<th>Electrophysiology</th>
<th>Psychophysics</th>
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<tbody>
<tr>
<td>Stimulus</td>
<td>Physical</td>
<td>Physical or Chemical</td>
</tr>
<tr>
<td>Data type</td>
<td>Objective</td>
<td>Behavioral</td>
</tr>
<tr>
<td>Patient effort</td>
<td>Passive (mostly)</td>
<td>Active</td>
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<tr>
<td>Potential for bias</td>
<td>Low</td>
<td>High (→ Forced choice)</td>
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Vision

UV-induced corneal "flash burns"

IR-induced cataracts

Laser-induced retinal injury

Acute Methanol retinopathy

Amine-induced glaucoma
Solvent-induced dyschromatopsia


Epidemic keratoconjunctivitis


Hearing
Impetus for hearing screening:

- Routine periodic surveillance
- OSHA-mandated
  - PEL = 90 dBA as an 8-hour TWA
    - 5 dBA “exchange rate” (havling of time)
  - 85 dBA “Action Level” for hearing conservation program (warning, IHE, PPE & surveillance)
- Symptomatic (hearing loss, tinnitus)
  - Self-reported
  - Other-reported (typically, spouse / partner)
Types of hearing loss:

- Conductive
  - External ear, e.g.:
    - Cerumenous impactoin
    - Exostosis ("surfer's ear")
  - Middle ear, e.g.:
    - Otosclerosis, TM perf; Cholesteatoma

- Sensorineural
  - Presbyacusis
  - Ototoxicity (drugs & indust. chemicals)
  - Noise-related

High-frequency hearing loss

Age Noise

Asymmetric hearing loss

Asymmetric noise exposure Acoustic neuroma

https://www.enteducationswansea.org/hearing-loss
https://clinicalgate.com/noise-induced-hearing-loss/
Solvent-noise interaction in hearing loss


Vestibular Function

Characterization & DDX of “dizziness”

- Lightheadedness
  - Orthostatic hypotension
  - Hyperventilation (e.g., panic attacks)
  - Intoxication (e.g., solvents)
  - Post-concussive
- Vertigo
  - Benign positional
  - Labyrinthitis / Meniere’s
  - Rotation / Acceleration / Optokinetic
  - Barometric (“alternobaric”)
Vertigo: Rotation / Acceleration / Opticokinetic

Vertigo: Alternobaric
Dix-Hallpike Maneuver

“Miner’s nystagmus”

Olfaction
Olfaction vs. Trigeminal Sensation

Maxillary N.
Ethmoidal N.
Infraorbital N.


Olfactory Disorders
- Decreased olfaction
  - Hyposmia
  - Anosmia
- Dysosmias (distorted olfaction)
  - Cacosmia
  - Torquosmia
- Phantosmia

DDX of Acquired Olfactory Loss

- Age / Neurodegenerative disorders
- Conductive loss
  - Allergy, infection, neoplasm
- Head trauma
- Smoking
- Occupational chemical insults
  - Metals (Cd, Ni, Cr, Zn...)
  - Irritants (NH₃, Cl₂, SO₂...)
  - Solvents (acetone, benzene, dibasic esters...)

21 y/o/m boatbuilder with OR, hyposmia, OA & ACD

Vapor-phase stimuli
Olfactory Testing

- Qualitative (Odor ID)
  - Microencapsulated
  - Felt-tipped pens

- Quantitative (Odor detection)
  - Squeeze bottles
  - Felt-tipped pens
  - Alcohol Sniff Test

Taste

Gustatory Dysfunction

- Quantitative Disorders
  - Hypergeusia
  - Hypogeusia
  - Ageusia

- Qualitative Disorders
  - Dysgeusia
  - Parageusia
  - Phantogeusia
### Special Senses: Causal Agents

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<td>IR, UV, lasers; Computer Ergo</td>
<td>Amines, Methanol, Misc. Solvents, CO; Viral conjunctivitis</td>
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<tr>
<td><strong>Hearing</strong></td>
<td>Noise</td>
<td>Solvents, Pb; Viral ?</td>
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<tr>
<td><strong>Vestibular function</strong></td>
<td>Acceleration; Optokinetic; Miners' nystagmus</td>
<td>Solvents; Organo-phosphates, Hg, etc?; Viral ?</td>
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<tr>
<td><strong>Olfaction</strong></td>
<td>Head trauma</td>
<td>Metals (Cd, Cr, Ni); Solvents (various); Acids, Caustics; Post-viral</td>
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<td><strong>Taste</strong></td>
<td>Ionizing radiation</td>
<td>Cd, Hg, Sb, Cr, Pb, Se, Te, HSe; Bell's palsy?</td>
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### References