



CONCUSSION
HEALTH

Balance and Peripheral Neuropathy

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Balance Systems

How our balance systems
work...

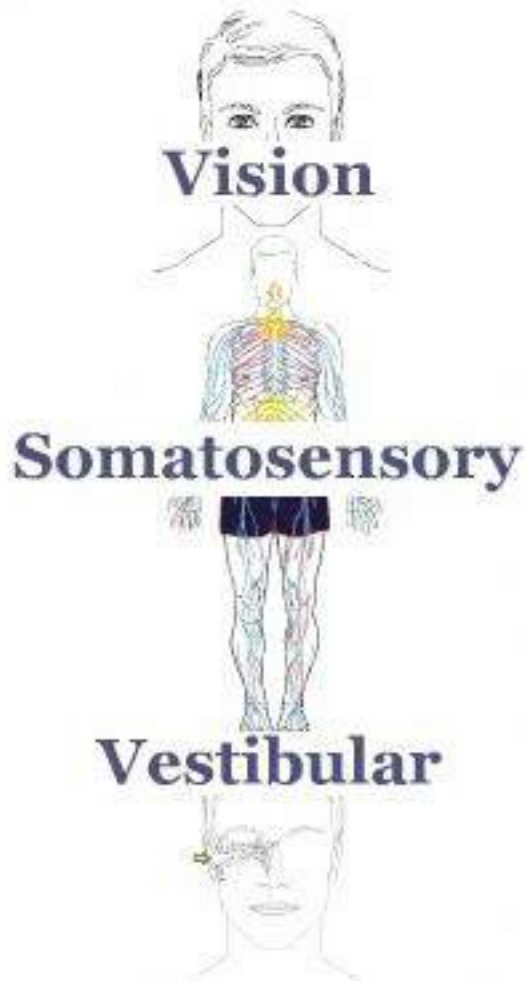
The Major Components of Balance

1. Accurately receiving information from the sensory systems to orient the body's position relative to our world.
2. Our brain processes the information.
3. Normal function of our sensory systems and our brain allow us to stay upright and move around our environment w/out dizziness or losing our balance.

Components of Balance

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Sensory Input

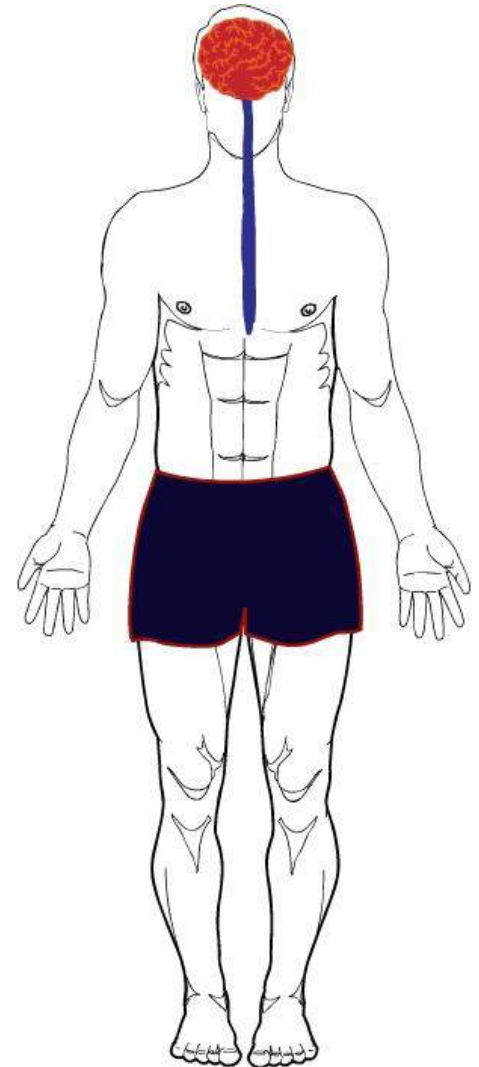


Our Balance Systems

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Our brain is the “computer” to process the information we receive from our different senses: vision, somatosensory, and vestibular.

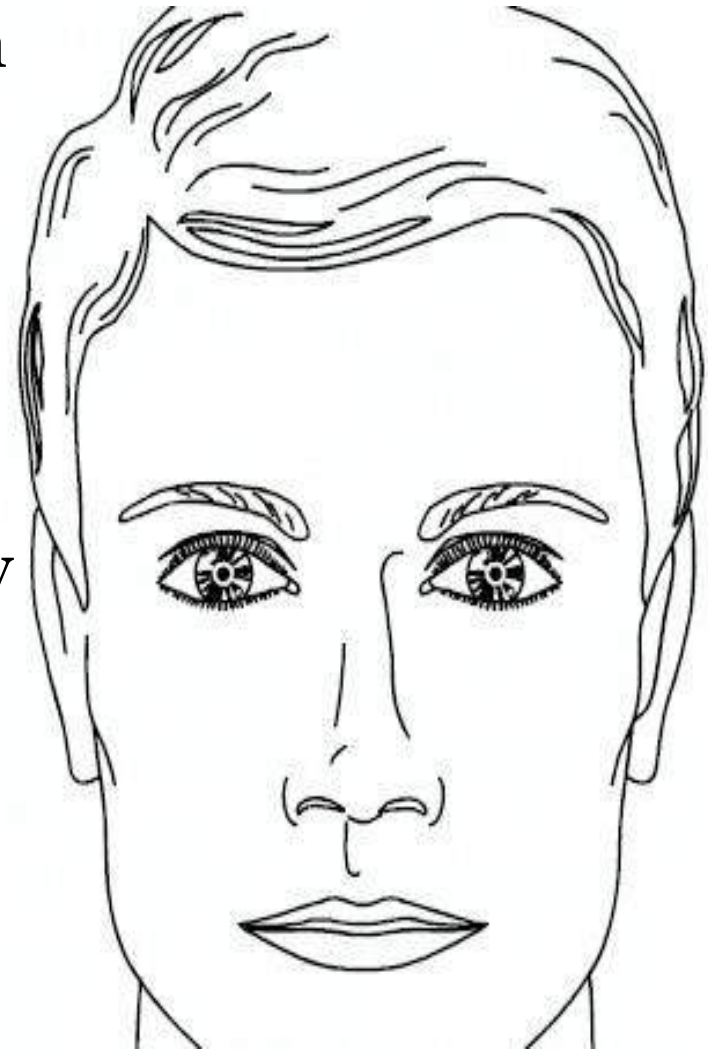
...the result from either is sensory conflict that can lead to a variety of signs and symptoms.



Visual Cues

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- Input to central nervous system (CNS)
 - Motion with respect to objects/environment
 - Peripheral vision more influential
- More than just acuity...accuracy and ability
 - Tracking, targets, teaming, focusing
- Not always reliable

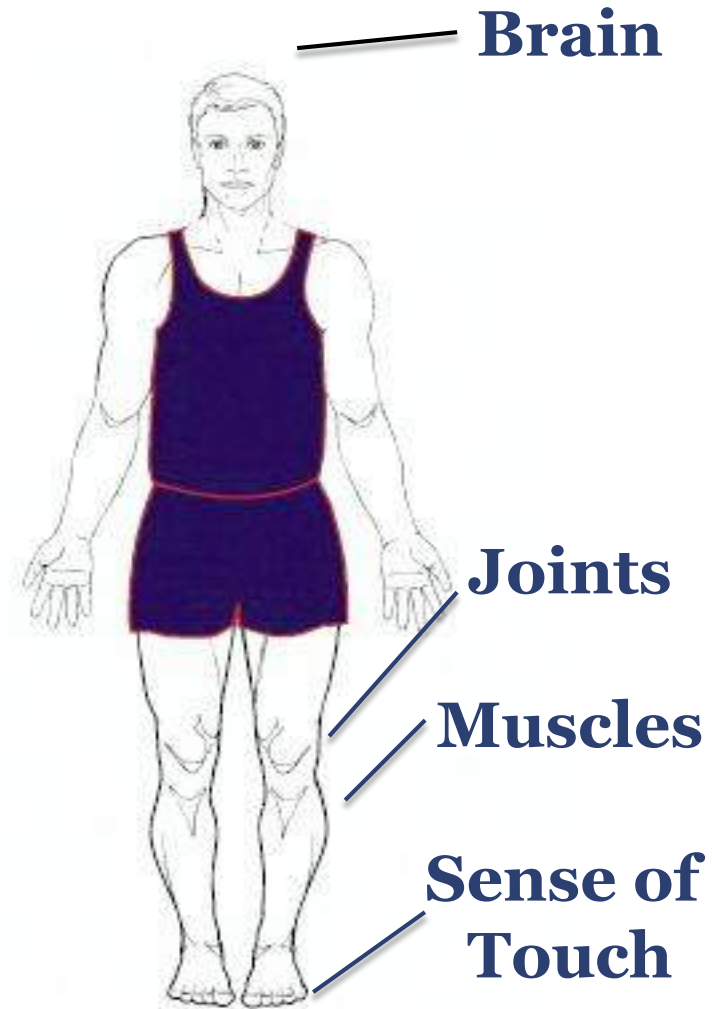


Somatosensory Cues

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- Input to CNS
 - Relationship of body segments to one another
 - Body's position & motion in space with reference to supporting surface
 - Dominant input when support surface is firm, flat and fixed

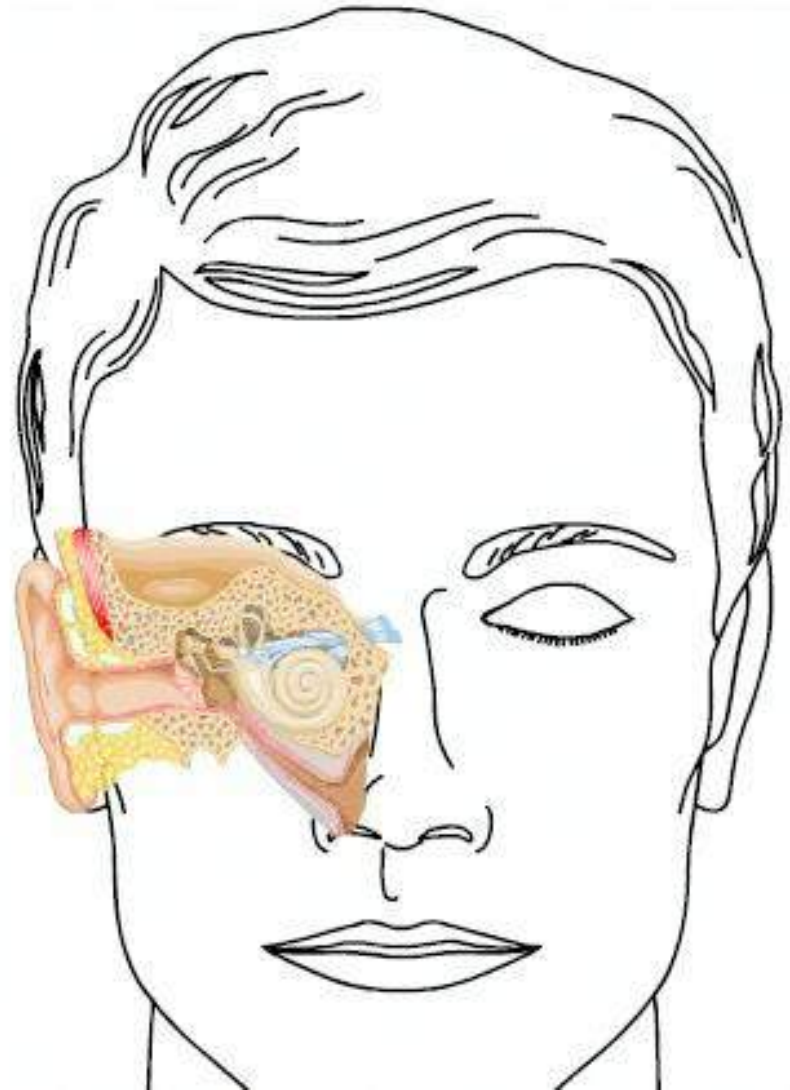
- Not always reliable



Vestibular Cues

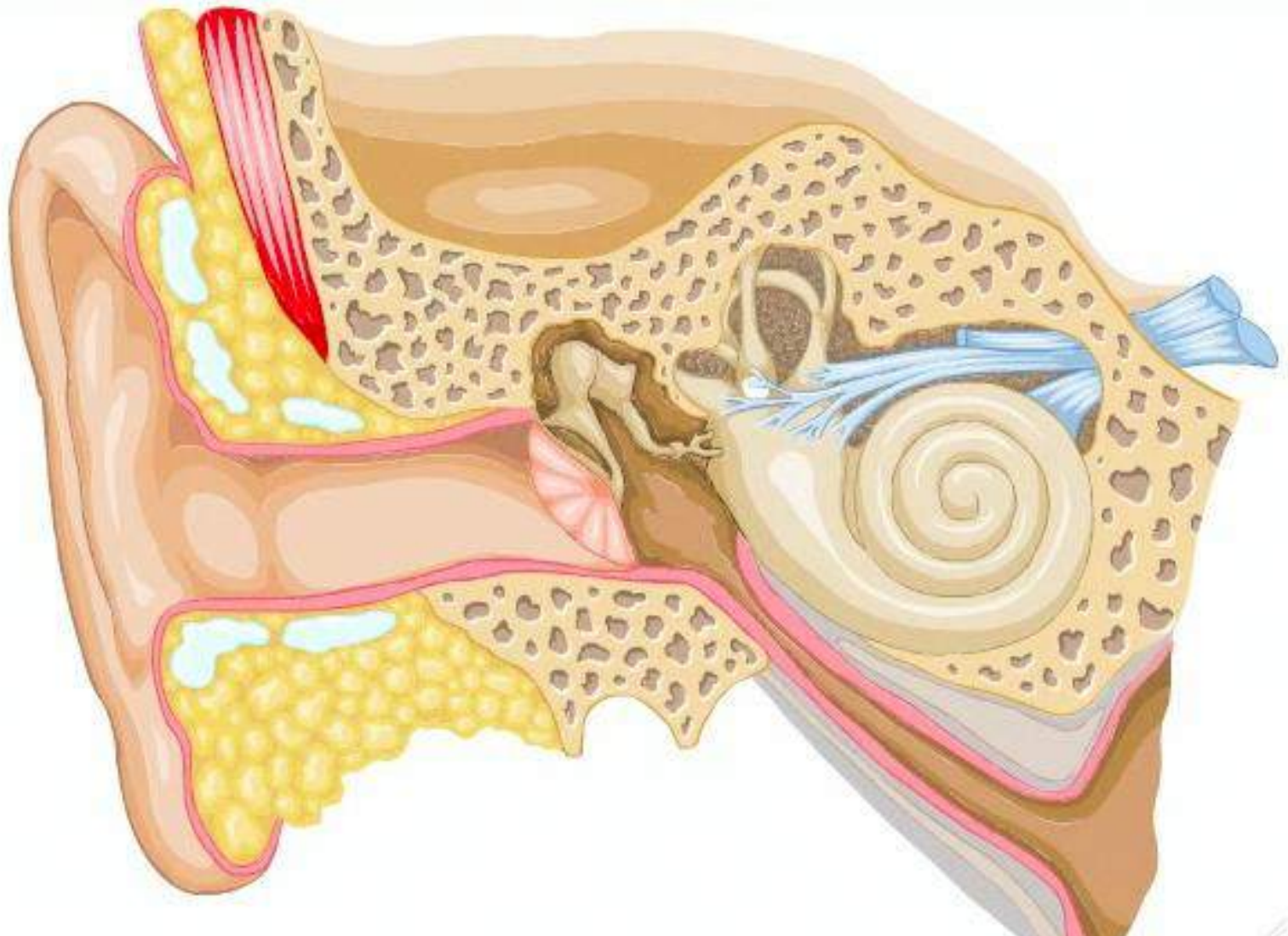
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- Input to CNS
 - Provides information about where we are in space – upright or leaning
- Inner ear controls info about eye & head coordination, balance and ANS
- We rely on vestibular cues most during movement



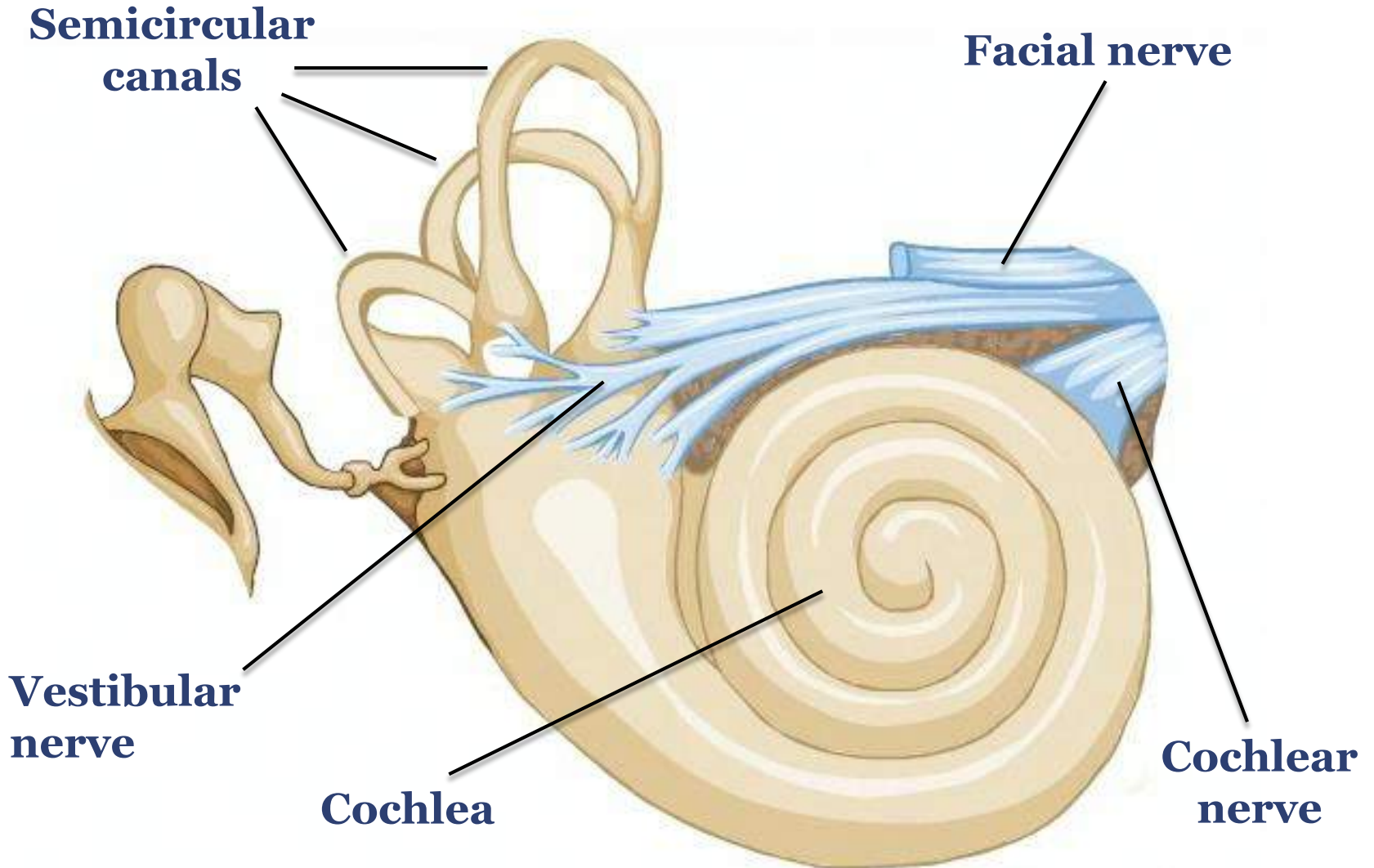
Outer Ear to Inner Ear

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A Closer Look at the Peripheral Vestibular System

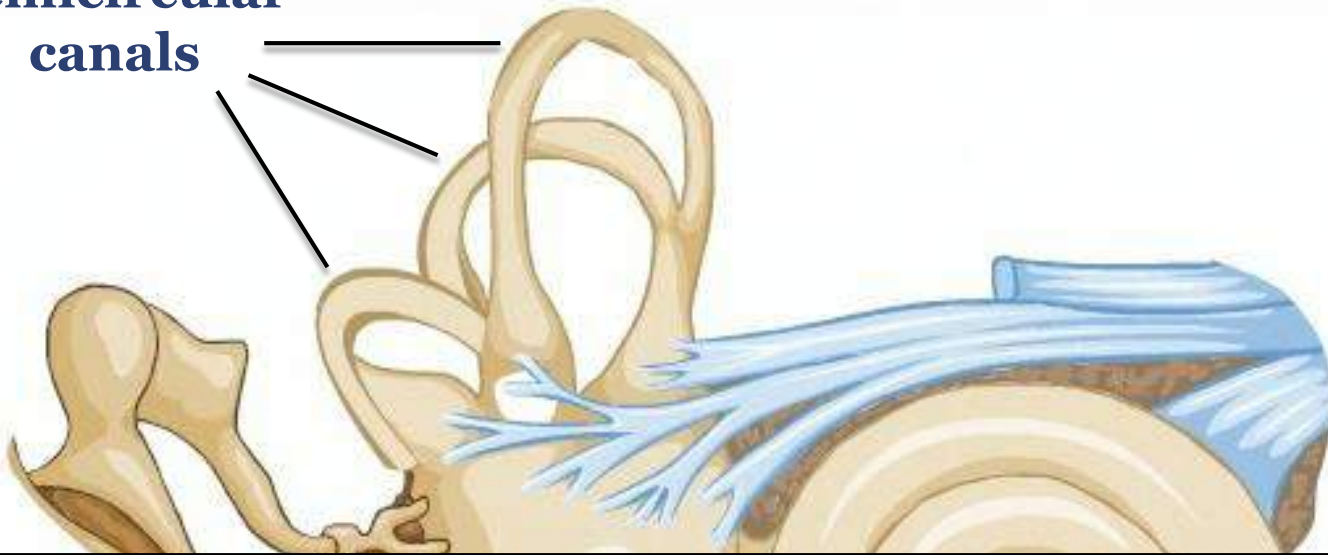
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Labyrinthine Structures

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Semicircular canals



- ***Semicircular canals (3):** anterior, posterior and horizontal. The canals provide sensory input about head **velocity**, or *angular motion*, that results in a **coordination of eye movement and head movement**.

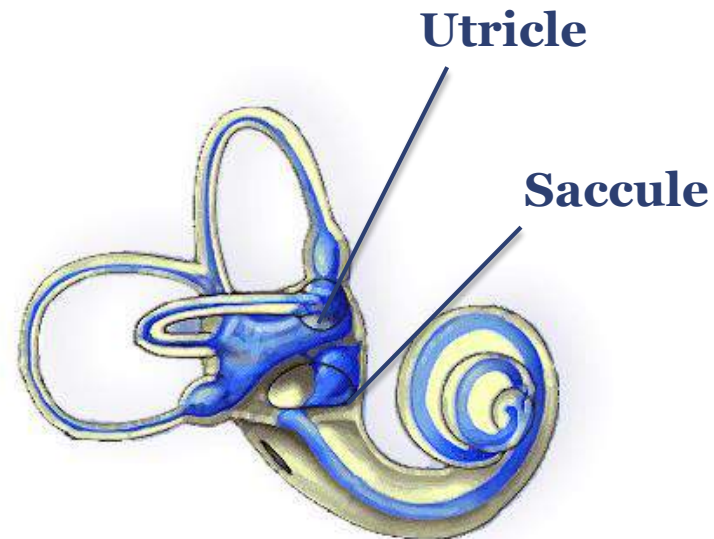
Vestibular Motor Output - Reflex

- Vestibular-Ocular Reflex (VOR): The purpose is to maintain stable vision during head movement, thus controlling eye-head coordination.
- *Try this: hold your thumb out and move it quickly. Does it get blurry? “Yes,” because your eyes don’t move that fast. Now, hold your thumb still and move your head side to side as if saying, “no, no, no”. Does your thumb stay still? “Yes,” (hopefully)...thanks to your inner ear.*

Otolith Organ Structures

Otoliths (2) -- provides sensory input about change in head **acceleration**, or *linear motion*, which conveys information about spinal and leg musculature via “**balance strategies**.”

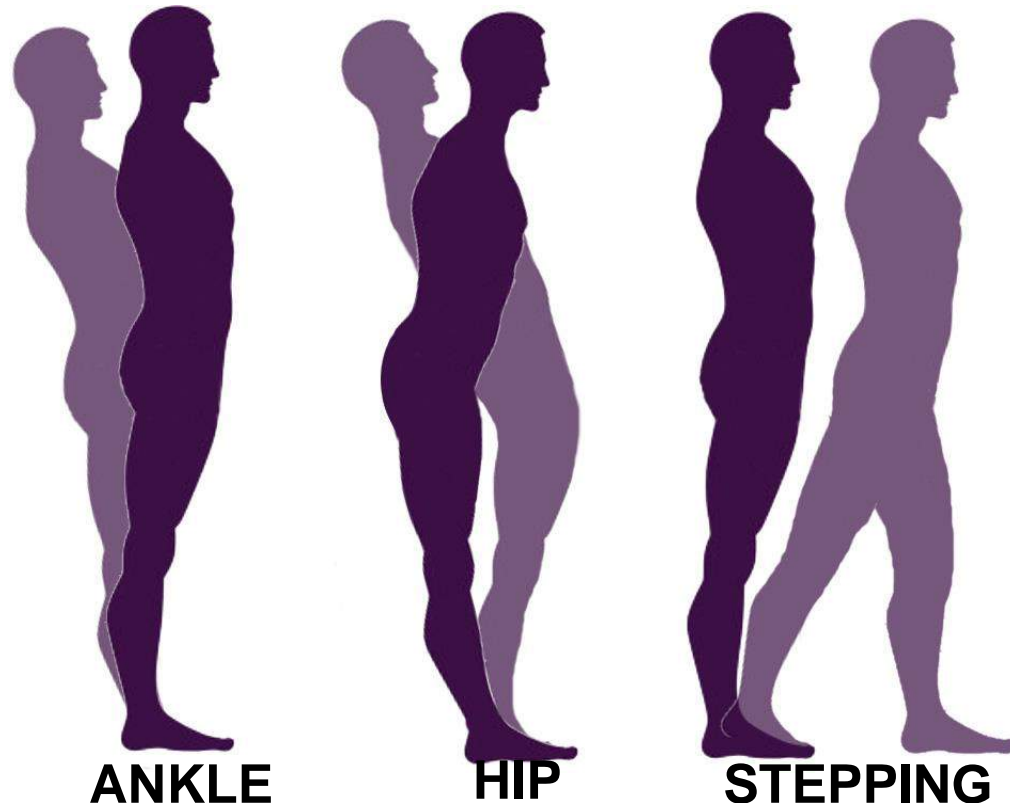
The utricle senses horizontal linear while the saccule contributes to vertical movements.



Vestibular Motor Output - Reflex

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- Vestibular Spinal Reflex (VSR): The purpose is to stabilize the head and body, thus controlling skeletal muscle and coordination for balance



Other Important Structures

- **Endolymphatic Fluid** -- a fluid confined within the labyrinth and cochlea, containing a high K:Na ratio
- **Endolymphatic Sac** – reabsorbs the endolymph produced by the inner ear after it has flowed through the ear
- **Vestibular Nerve** -- transmits signals throughout the internal auditory canal (IAC) which also contains the cochlear nerve, the facial nerve and the labyrinthine artery.
 - Blood supply is primarily from the anteroinferior cerebellar artery

How It All Works: labyrinth

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- Sensory hair cells convert head motion (both “angular” and “linear”) into neural firing.
- These messages are sent to the brain, resulting in: orientation, eye and head coordination, postural stability and even assists with regulating blood volume and pressure.



Why Consider the Inner Ear?

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- Our inner ear is our “gyroscope” of where we are in space.
- One part of our inner ear provides info on hearing the other part provides information about eye-head coordination and balance.
- Our inner ear also helps regulate our autonomic nervous system.
- Decreased blood flow to the inner ear can result in damage.

Consider the Impact...

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- Inner ear impairments are common in patients with peripheral neuropathy

- Impairments may result in a variety of symptoms
 - Dizziness
 - Balance Problems
 - Foggy Headedness
 - Visual Changes
 - Hearing Changes
 - Affect blood pressure

Vestibular Rehabilitation (VR)?

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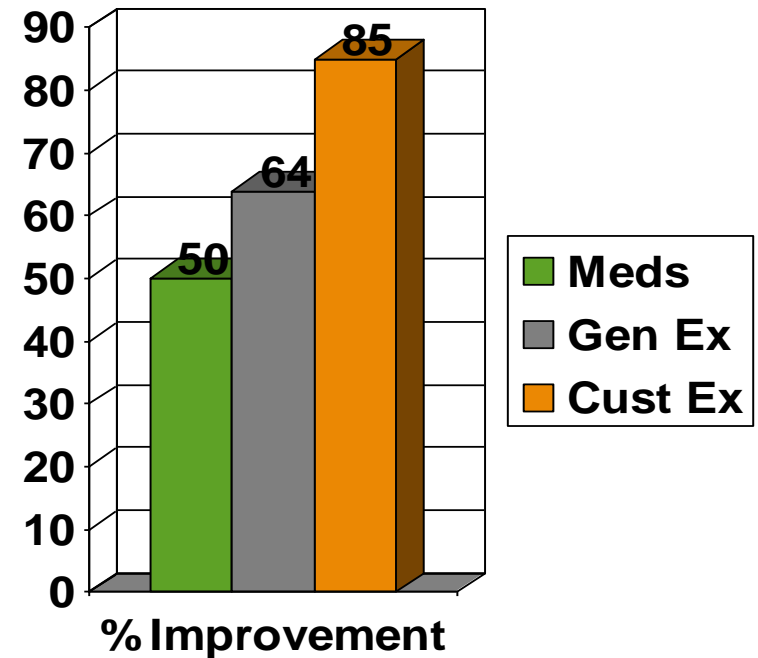
- **VR is an exercise approach to decrease or eliminate symptoms of dizziness, imbalance and/or nausea due to inner ear disorders.**
- **VR includes specific exercises that “retrain” the brain to more accurately interpret and use information from the inner ear.**

Benefits of VR

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- <50% with medicine alone¹⁰
- 64% with general exercise program¹⁰
- 85% with customized vestibular exercises*¹¹

*when provided by a specially trained therapist



What About the Benefits of Rehab w/PN?

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- Physical Therapy is often recommended for PN:
 - To improve strength, range of motion, manage pain
 - Make recommendations for an assistive device
 - And, improve balance**

- **Keep in mind, however, that even w/therapy...
 - You will likely still fatigue easily
 - You may still feel unsteady on unstable surfaces and walking downhill.
 - You may “test” better after therapy but often don’t “feel” better after therapy

Steps to Take

- ❑ Maintain a healthy diet
- ❑ Stay active and hydrated (with water)
- ❑ Wear socks and wear comfortable (appropriately fitting) shoes
- ❑ Physical Therapy may be of benefit as well as yoga, Tai Chi
- ❑ Massage Therapy for pain, improve circulation and control swelling
- ❑ Warm baths may help – be cautious about temperature not being too hot
- ❑ Over the counter options...vit B supplements (but avoid excessive B6); botanical & primrose oils
- ❑ And, always consult with your physician

Thank you!

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Specializing in dizziness, balance & hearing disorders.