

# Good Vibrations: Hacking Motion Sickness on the Cheap

# **INTRODUCTION**

# Motion Sickness

- No universally accepted definition
- Defined by signs and symptoms, which varies
- Agreed that it came about when man first tried to improve natural mobility
- Greeks had first recorded account, occurred at sea
  - Where the term *nausea* came from
    - “naus-” meaning of the sea
    - “-ea” being related to sick

# Statistics

- 90% of the world's population suffer from it at one point in their lives
- 300 million sufferers live in the U.S.
  - 9 to 75 have debilitating response
  - 2 million are forced to visit a doctor

# Susceptibility

- Predisposition to motion sickness can be inherited
- Some races can be more effected than others

# Types of Motion Sickness

- Car sickness
- Air sickness (occurs in an aircraft of some sort)
- Sea sickness
- Simulation sickness

# Disproven Theories

- “Blood and Guts”
- Result of Respiratory Issues
- Reaction to shock to the central and autonomic nervous systems
- Infection similar to Cholera and Yellow Fever
- Overstimulation

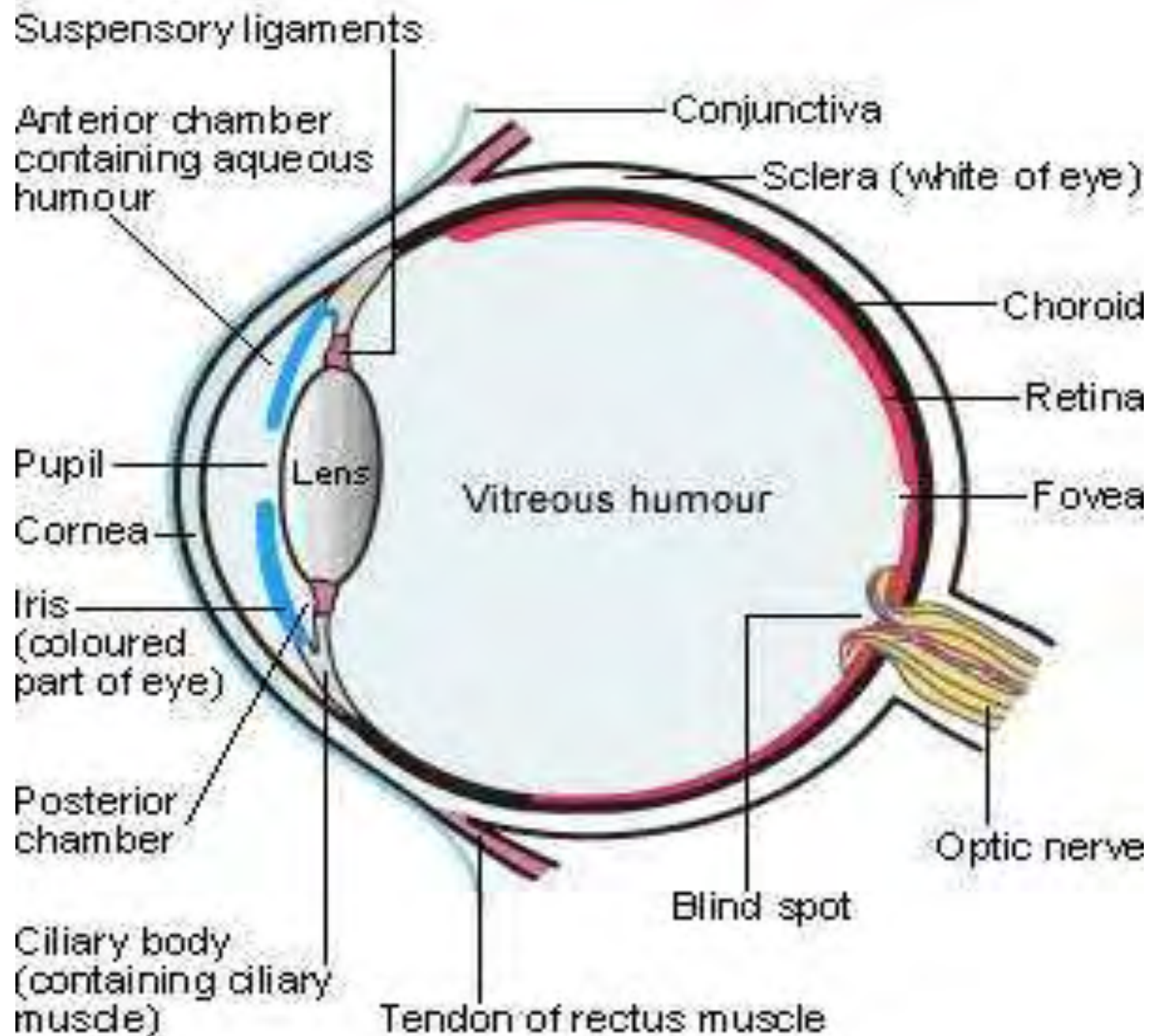
# **FOVEAL SLIP THEORY**



# Overview of Foveal Slip

- Fixation disparity leads to lack of visual acuity
- Occurs when there is a misalignment of the eye
- Can be horizontal and/or vertical
- Results in over- or under-convergence of eyes at a fixation point

- Misalignment of the fovea is only a few arcminutes
  - One-sixtieth ( $1/60$ ) of a degree
- Foveal slip eventually leads to depth perception problems



# Fovea

- Located in the center of the Macula region
  - Oval-shaped, yellow spot
  - Near the center of the retina
- Responsible for central vision
  - Reading
  - Driving
  - Watching tv or movies

# Foveal Slip and Motion Sickness

It's hypothesized that motion sickness that occurs during opti-kinetic stimulation is a result of foveal slip. As a result, an increase of foveal slip more often than not results in an increase of symptoms associated with motion sickness.

# **MOTOR-SENSORY CONFLICT THEORY**

# The Theory

States that motion sickness is a defense mechanism against neurotoxins and is triggered when sensory information (usually visual) about the body's position and movement is contradictory to the movement that is being sensed by your vestibular system, resulting in your body being unable to reach a state of homeostasis (basically a sense of balance).

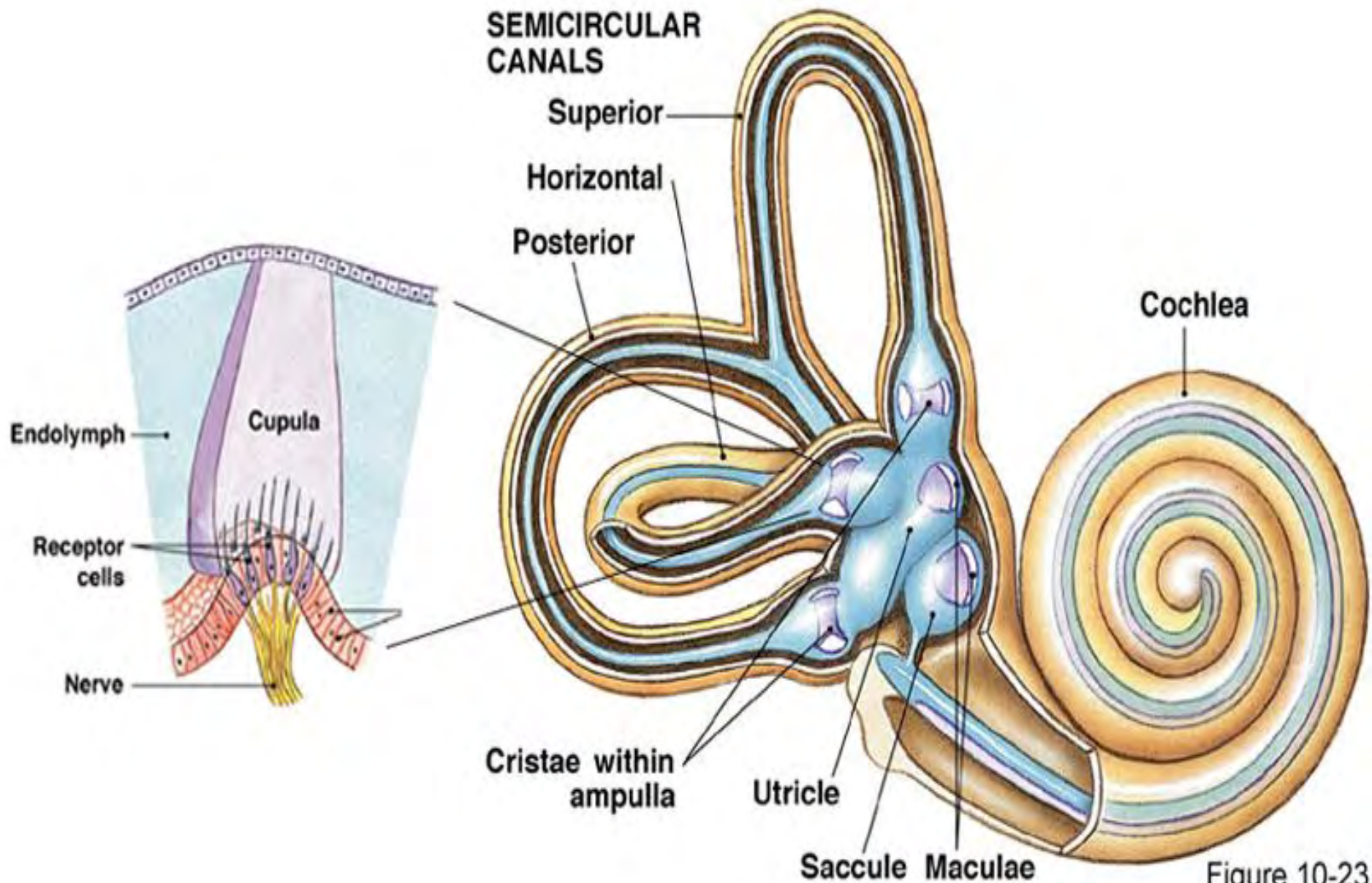


Figure 10-23



# Vestibular System

- Responsible for our balance and sense of spatial orientation
- Movement causes fluid from the endolymphatic sac to push against the cupula
- Cupula has hairs that translates mechanical movement into electrical signals

# For the engineers...

- The semicircular canals can be compared to a damped oscillator:

$$\theta(s) = \frac{\alpha s}{(T_1 s + 1)(T_2 s + 1)} \dot{q}(s)$$

- For humans, the time constants  $T_1$  and  $T_2$  are approximately 3 ms and 5 s, respectively.

- For typical head movements, which cover the frequency range of 0.1 Hz and 10 Hz, the deflection of the cupula is proportional to head-velocity.
- The velocity of the eyes must be opposite to the velocity of the head in order to have clear vision.

**CURRENT PREVENTION  
TECHNIQUES AND “TREATMENT”**

# Prevention

- Sitting where motion is felt the least
- Don't read
- Keeping head and body still
- Face forward in a reclining position
- Keep eyes on the horizon
- Keep window open
- Don't drink or smoke
- Eating small, low-fat, bland, and starchy foods

# Natural Healing

- Powder or liquid ginger
- Use acupuncture, acupressure, or mild electrical pulse at:
  - Neiguan or Pericardium (3 finger widths above the wrist)
  - Small intestine 17 (just below the earlobes, in the indentations behind the jawbone)

# Drugs!

- Diphenhydramine
  - Active ingredient in sleep aids
  - Cannot be used with infants
  - Not good for elderly, pregnant, or breast-feeders
  - Not good for people with glaucoma, heart disease, constipation, or enlarged prostate

# Drugs! (Cont.)

- Antihistamines
  - Most effective 30-60 minutes before a trip
  - Side effect: drowsiness and less alert
  - Shouldn't be used by people with emphysema or bronchitis



**DAS GOODS**

# Auroscillator

- Little box that produces a sound in the .01-10 kHz range
- Works using the motor-sensory theory as a basis
- It imitates the moving of your head in order to trick the brain

Material list, cost and schematics to be shown during the presentation.

# Stroboscopic Glasses

- Lights flash at 20 Hz with 8 ms dwell time
- Mounted just outside the wearer's peripheral vision
- Shouldn't cause epileptic seizures
- Prevents your eyes from going into a foveal slip

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Questions? Comments?

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