



# **“Embassy Encephalopathy”: Induced Hearing Loss, Cognitive Dysfunction and Neuropathological Changes - Possible Causes, Mechanisms, and Effects**

**James Giordano PhD**  
Departments of Neurology and Biochemistry  
Georgetown University Medical Center  
Washington, DC, USA

# Otopathology/Ototoxicity

Otopathology = damage to the ear

Ototoxicity = toxic effect to the ear

- Can affect the cochlea (hair cells, basilar membrane) and/or auditory nerve (n.VIII)
- Signs/symptoms:
  - Hearing loss/tinnitus
  - Vertigo/disequilibrium (and nausea)
  - Visual features (nyctagmus, oscillopsia)
  - Headache
    - Can be gradual or sudden
    - Can be unilateral or bilateral
    - Can be temporary or durable

# Possible Vectors for Otopathologic Effects

- Pharmacology

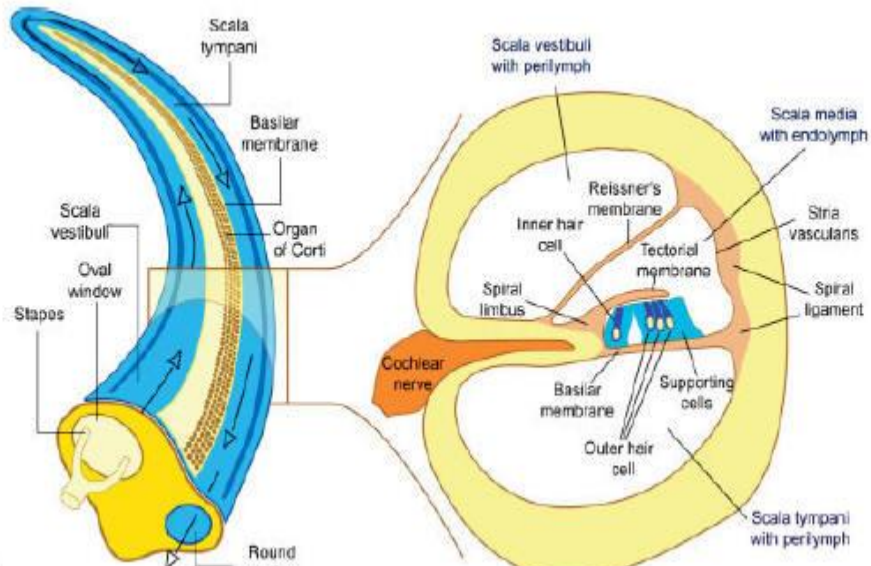
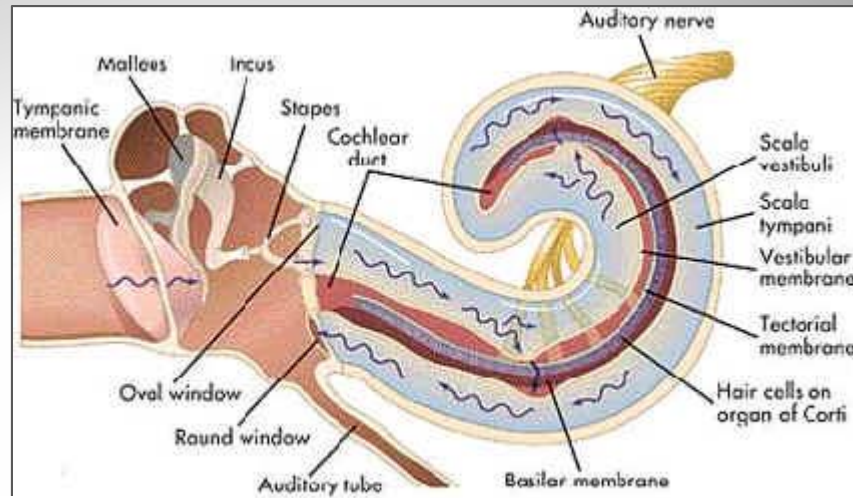
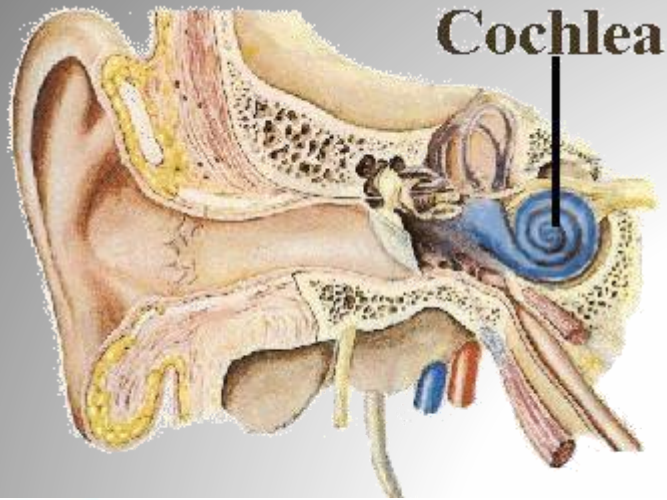
- Antibiotics
- Loop diuretics
- Cisplatin/carboplatin
- Salicylates
- Heavy metals (mercury/lead)
- Organic solvents

- Technology

- Subsonic stimulation (<20)
- Ultrasonic stimulation (>4500 Hz)
- Electromagnetic pulse stimulation

# Pathology

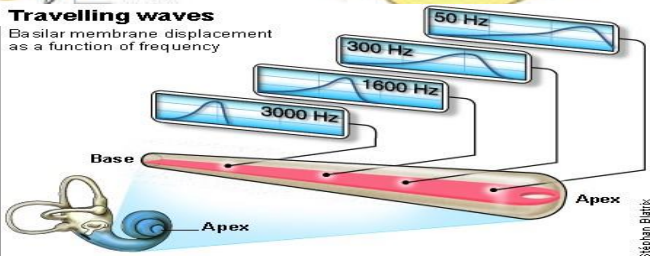
- **Inflammation**
- **Hair cell damage/death**
- **Membrane scarring**
- **Neurological damage**  
**(repeated excitotoxic post-synaptic dendritic loss)**



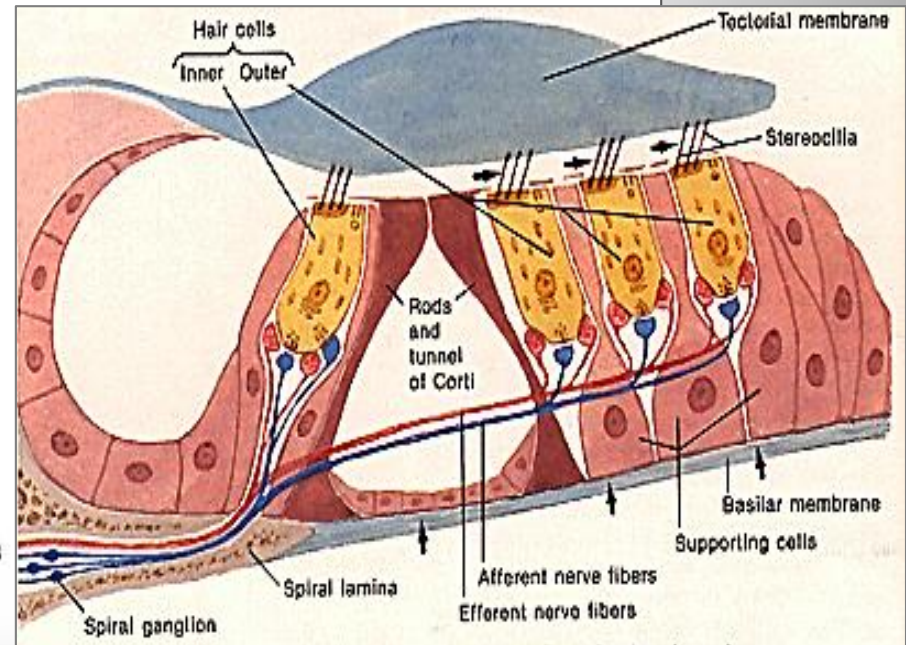
A

### Travelling waves

Basilar membrane displacement as a function of frequency



Stephan Bleck



B

# Induced Cognitive Dysfunction and Neuropathology

## Possible Vectors: Neuroweapon(s)

- Pharmacology
  - NMDA/Glutamate-R agonists
  - Heavy metals (mercury/lead)
  - Organic solvents
  - Low level organotoxins
- Technology
  - Sonic generators
  - EM pulse generators
  - Nanoparticulates

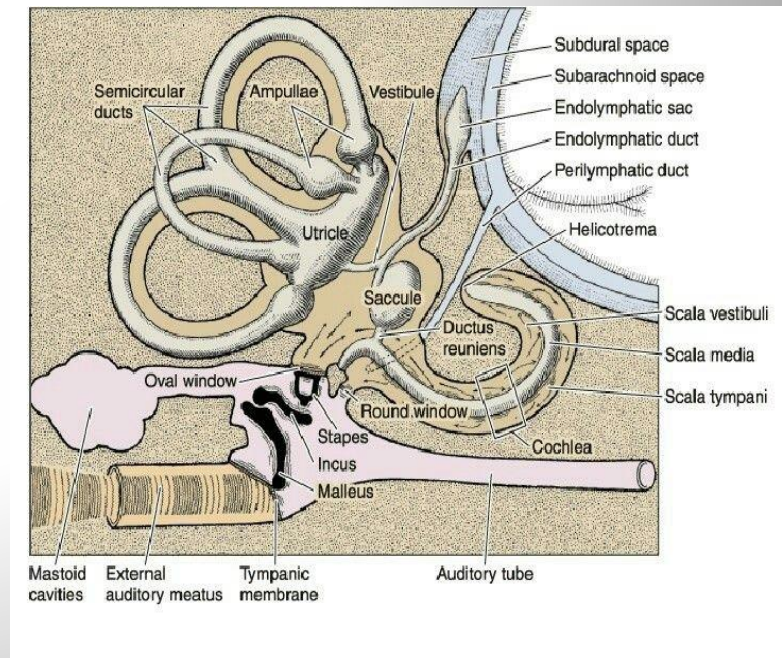
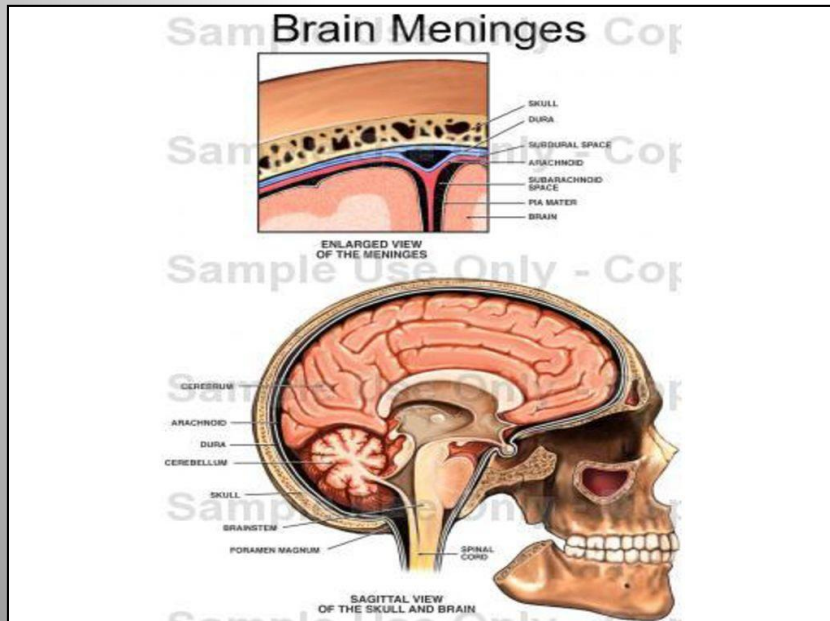


# Mechanisms of Effect

## Ultra-sonic Stimulating Devices

## EM Pulse Devices

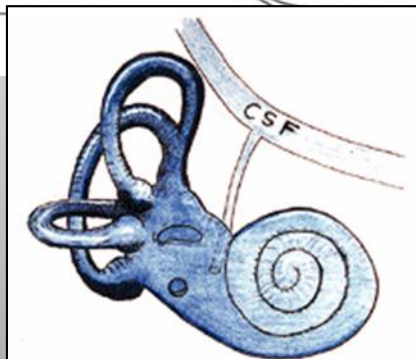
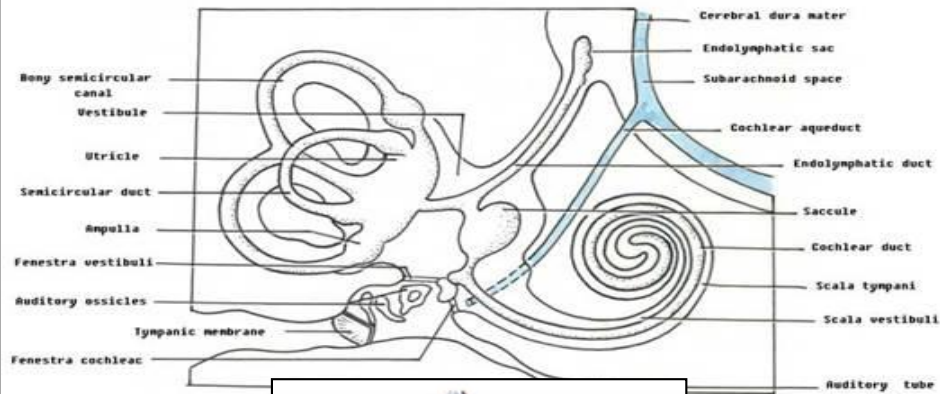
### Focused cavitation in fluid media



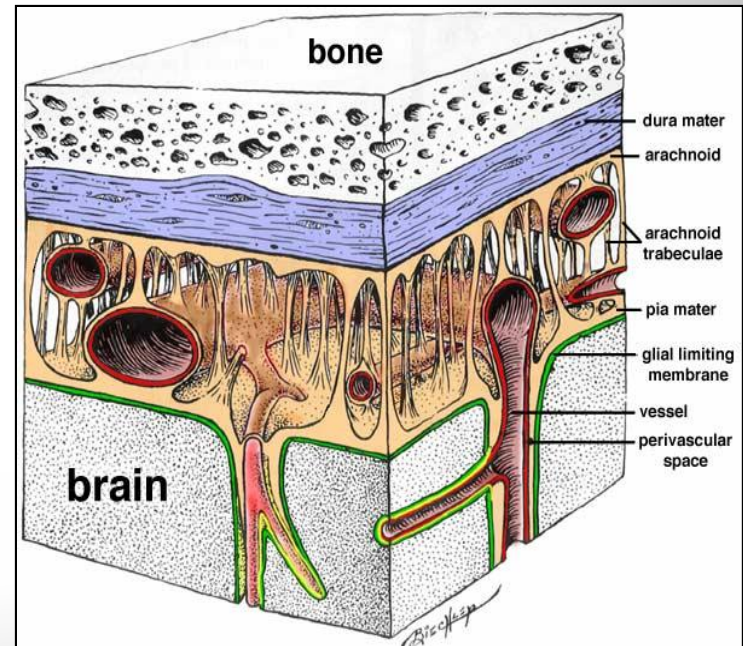
# Mechanisms of Effect

- Focused cavitation in fluid media

## Perilymph – Sub-arachnoidal media



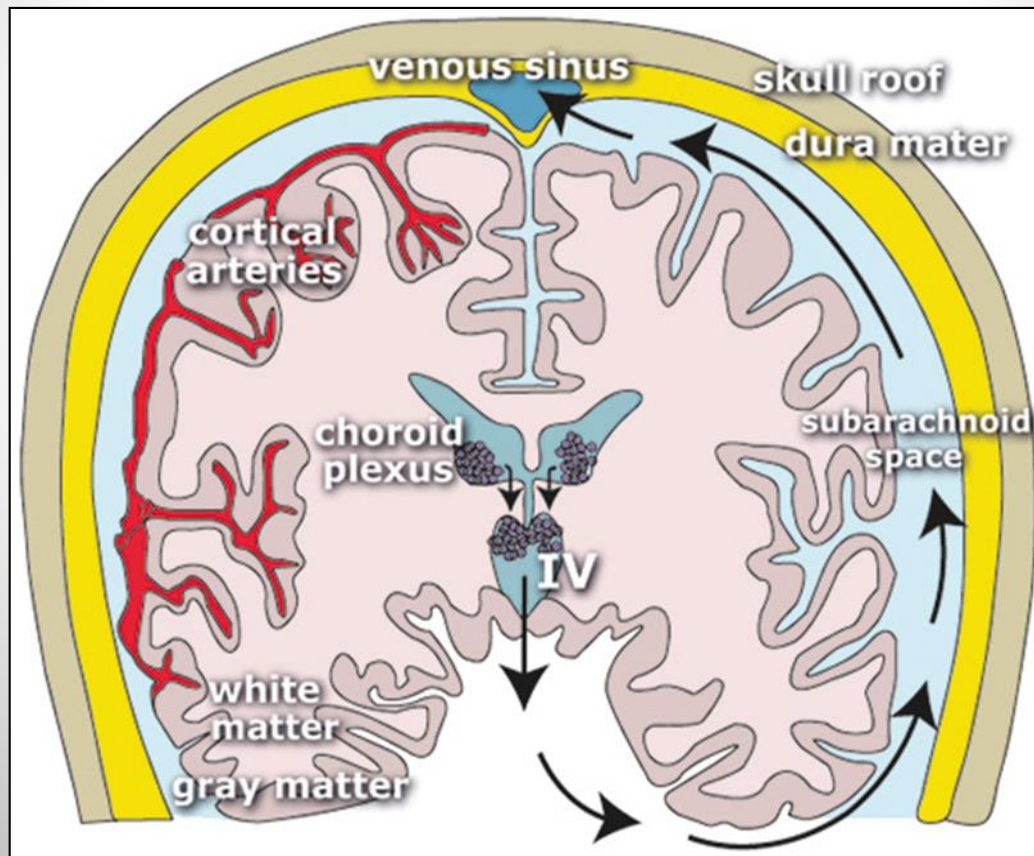
PERILYMPH





# Mechanisms of Effect

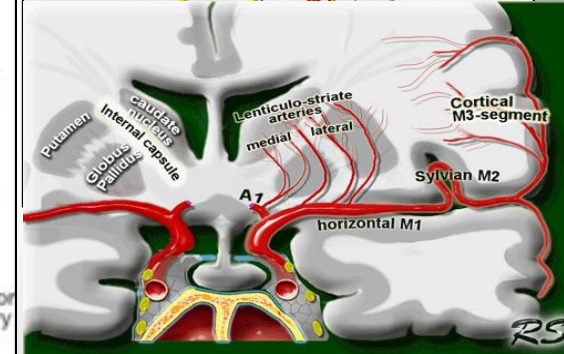
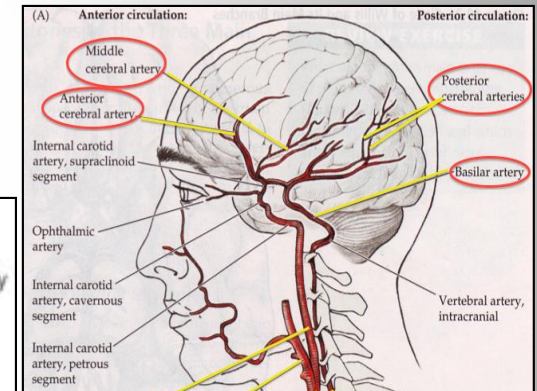
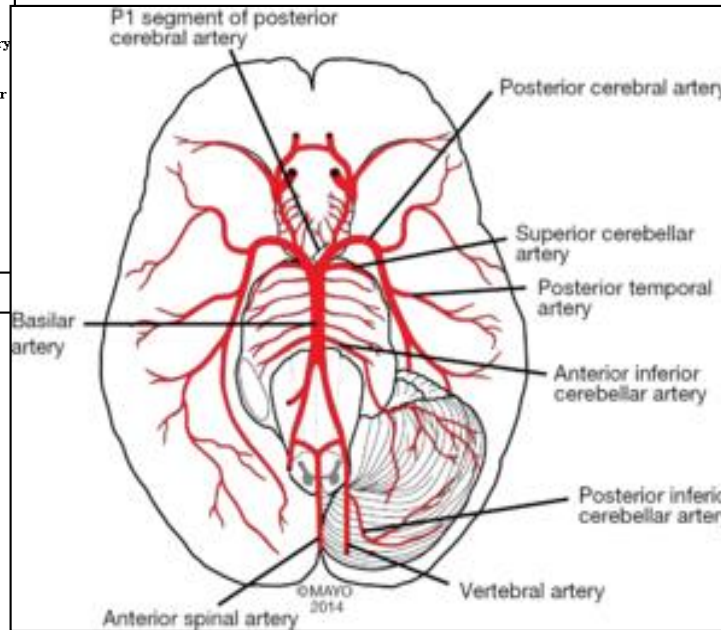
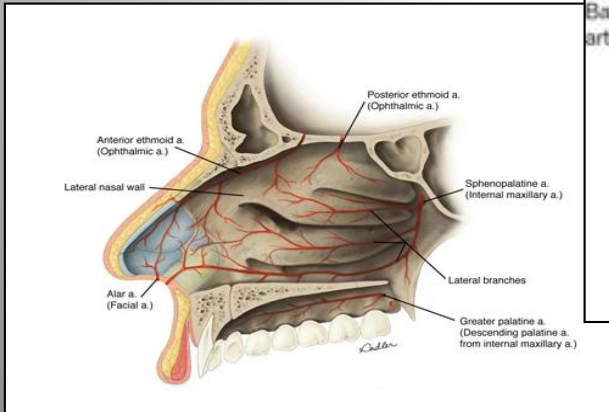
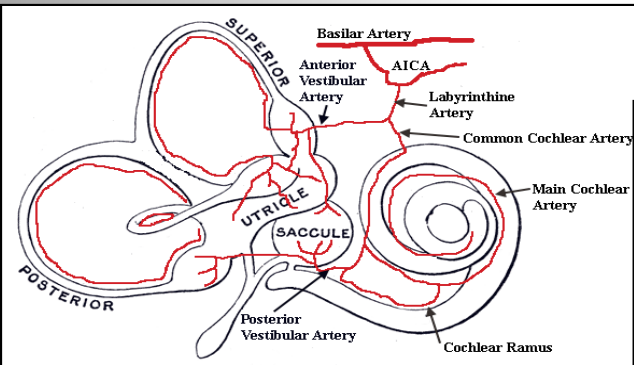
## Direct and/or Communicating Effects



# Mechanisms of Effect

## Focused cavitation in fluid media:

## Blood



# Assessment/Diagnosis

- **Neurocognitive assessment**
- **Neuroimaging**
- **Forensic anatomy**
- **Biopsy/Necropsy**
- **Modeling (*in vitro, in vivo, compusimulacra*)**

# Best Estimate Possibility/Probability

- *Drugs alone?*  
**Unlikely**
- *Ultrasonics?*  
**Very Possible/Probable**
- *EM Pulsing*  
– **Very Possible/Probable**
- *Combinatory approach?*
  - Drug/toxin
  - Sonic and/or EM pulse generator**Quite possible with (+) explanatory value**

*Possibly an artifactual environmental effect?*

**Yes, could be high end sonic stimulation coupled with solvent(s) and/or metals.**

***Probable?***

***Not likely***

# Contact

**Prof. James Giordano PhD**

**James.Giordano@georgetown.edu**



*GEORGETOWN UNIVERSITY*