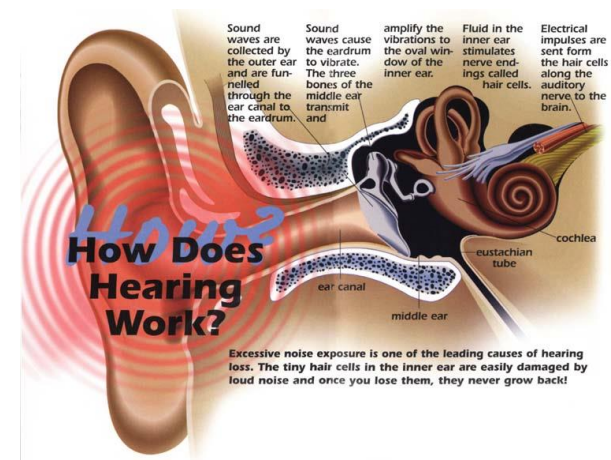




© Can Stock Photo - csp14834491

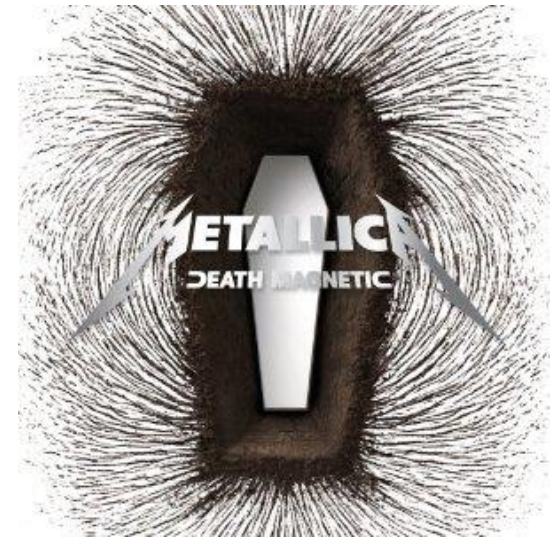
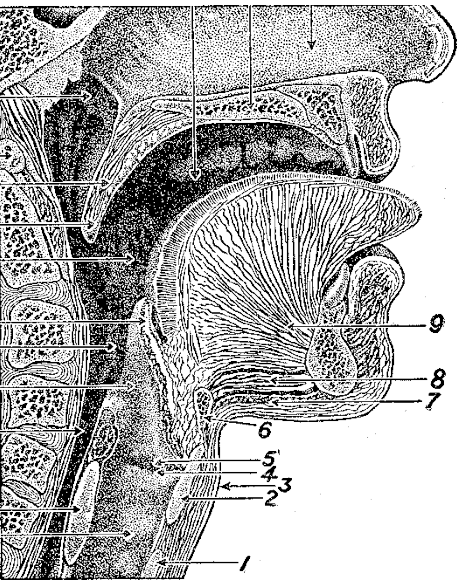


# Infocommunication Sound, hearing and speech

Tamás Csapó

<csapot@tmit.bme.hu>

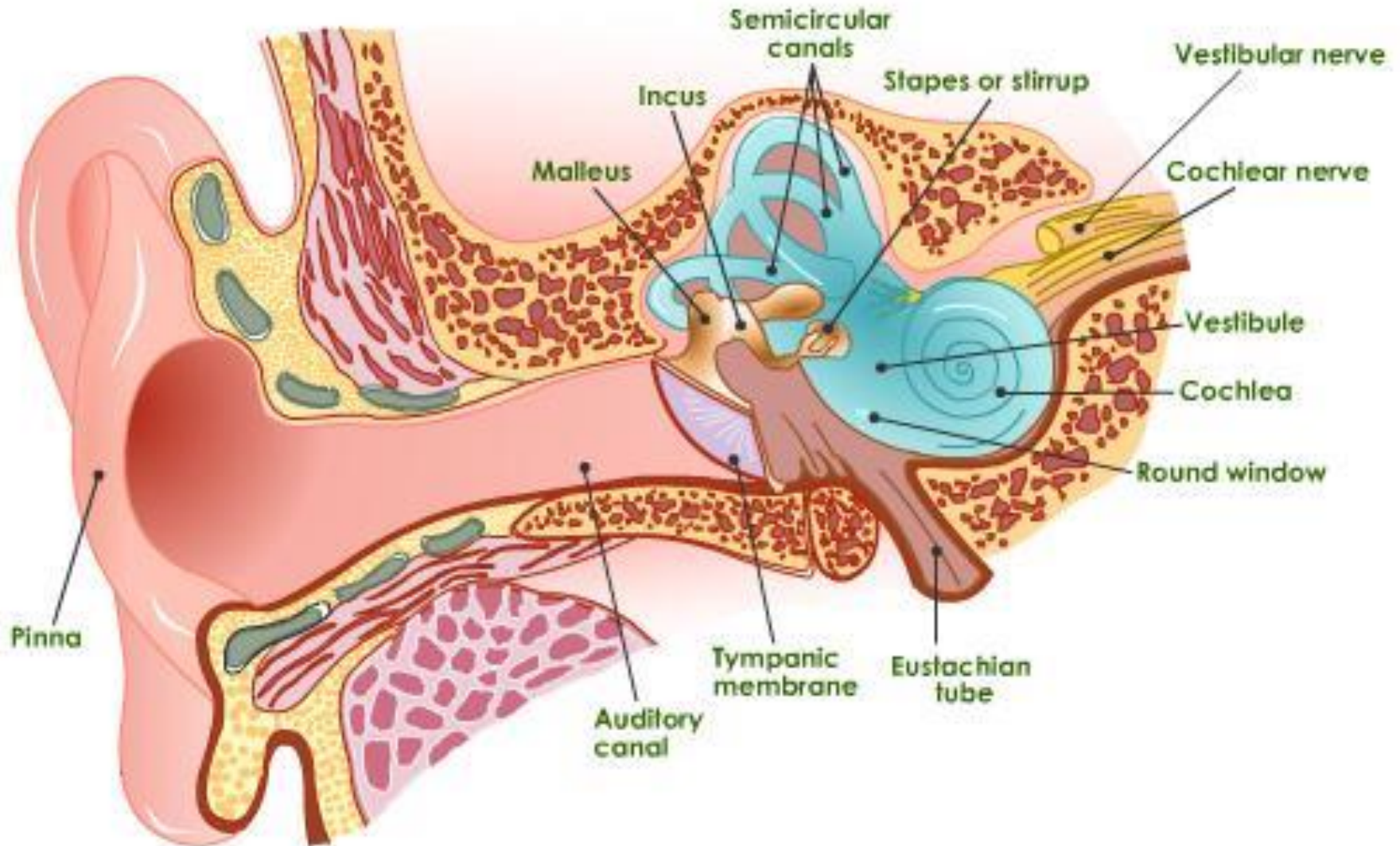
2018 Spring



# Topics

- Basic signal processing
- Sampling and quantization
- Analog modulation
- **Sound, hearing and speech**
- Digital baseband modulation
- Digital carrier modulation
- Error Detection Coding
- Error Correction Coding
- Radio, guided waves
- Light and vision
- Radio Communication
- Video Broadcasting
- GSM, Mobile communication

# Structure of the human ear

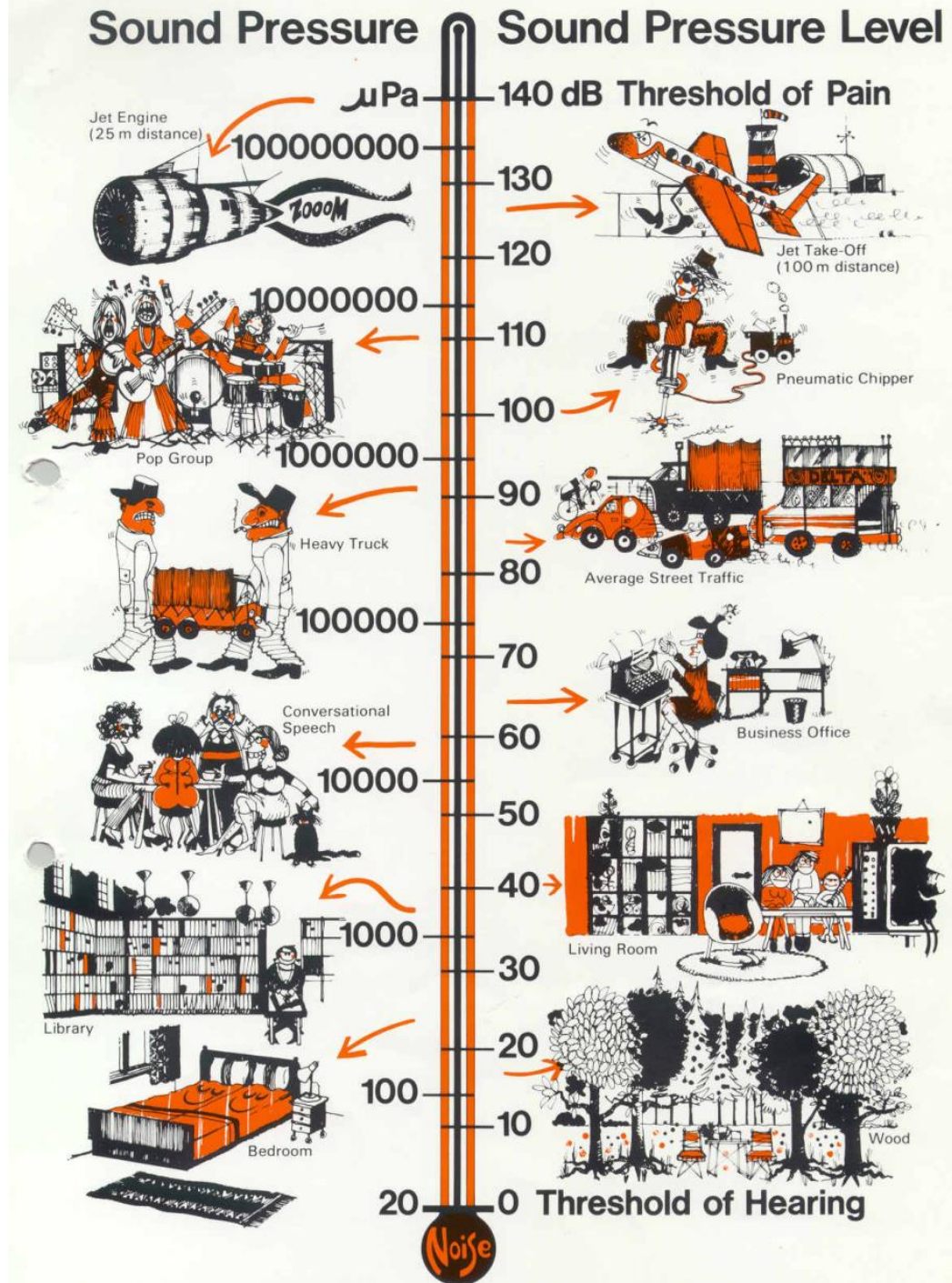


# Békésy György / Georg von Békésy

Nobel prize in 1961 (function of the cochlea)



# Sound pressure level



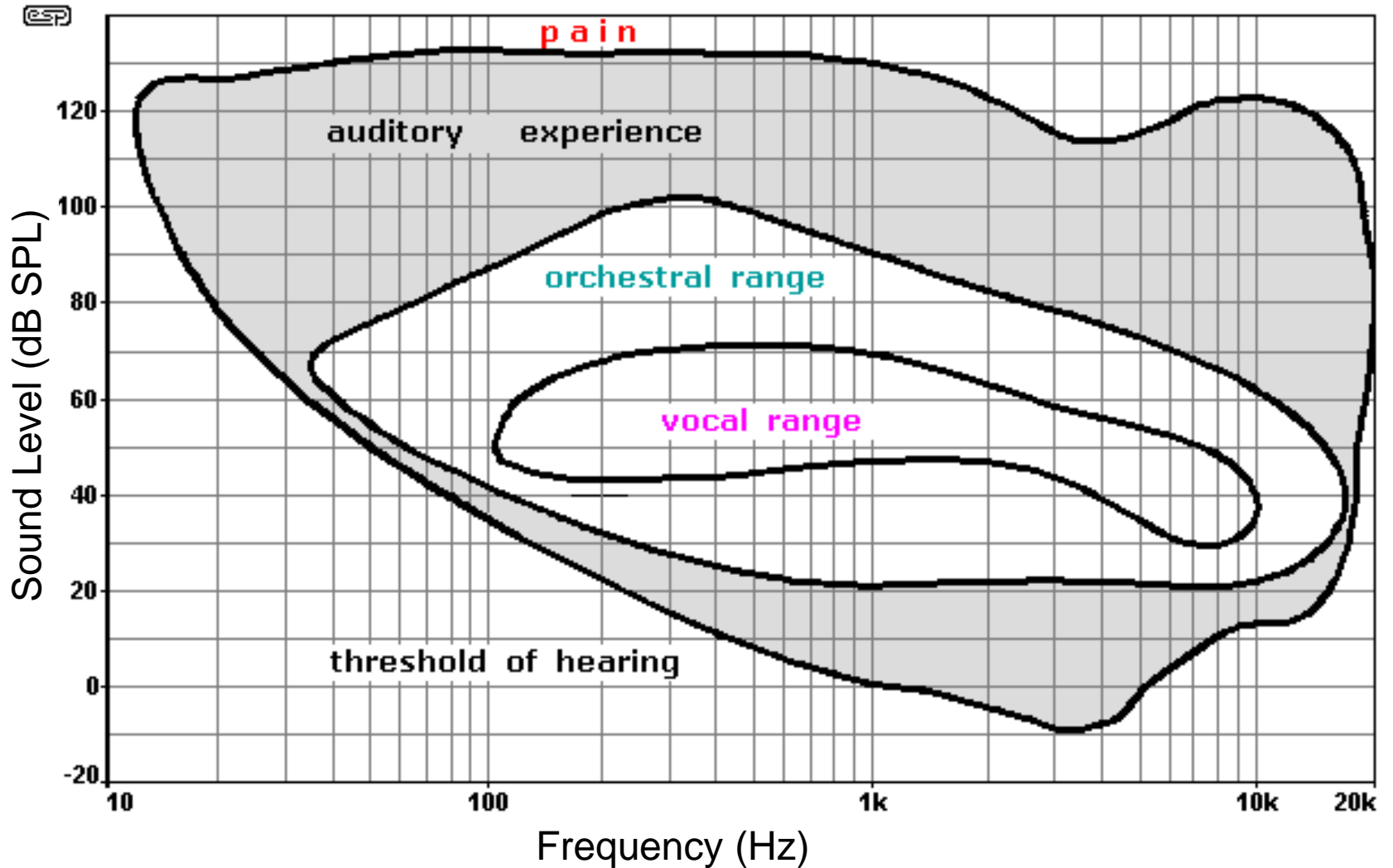
Source:  
<http://personal.cityu.edu.hk/~bsapplec/sound.htm>

# Sound pressure level

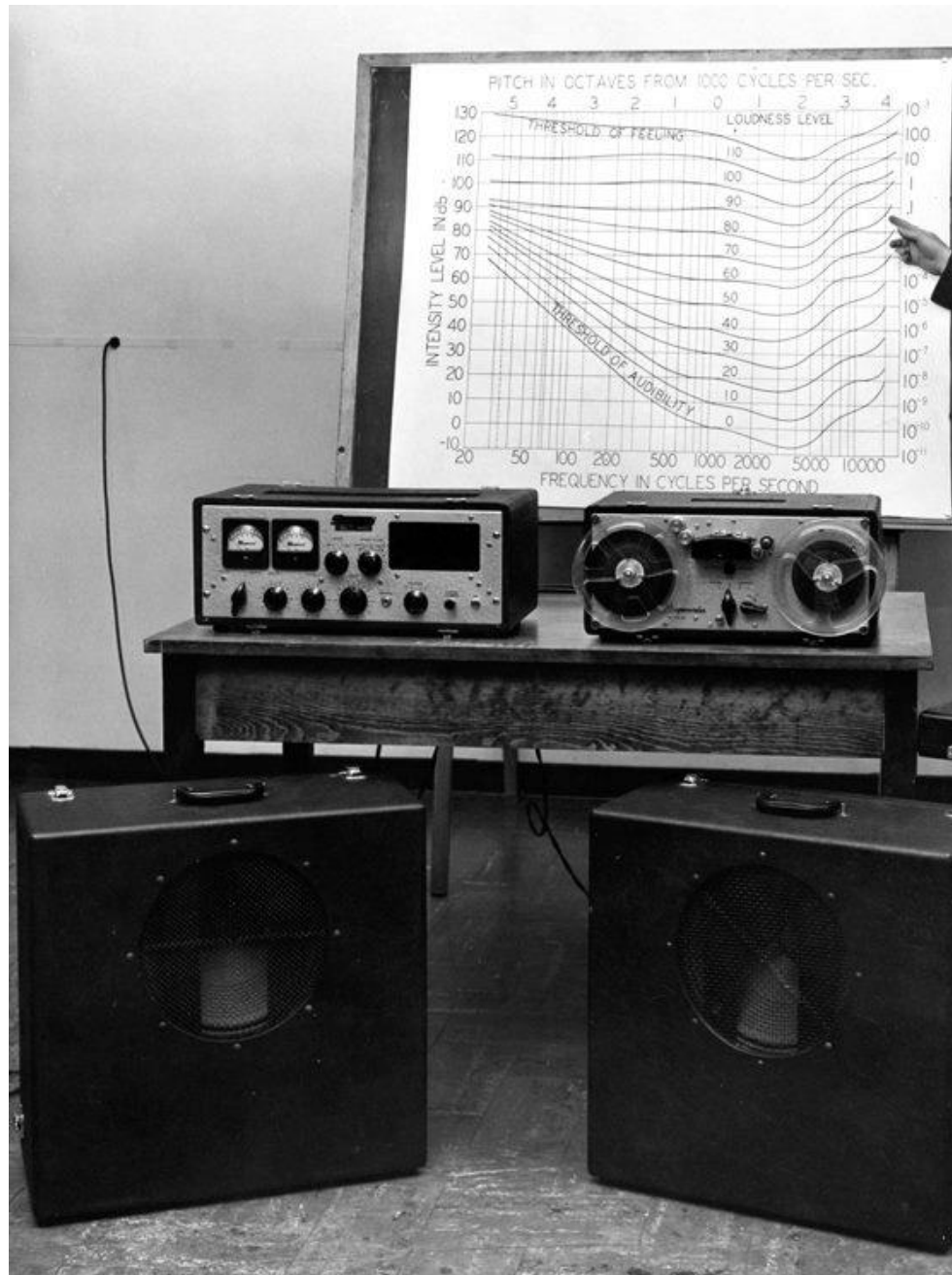
- 440 Hz tone (A4 on musical scale)
  - reduced in 1 dB steps
  - reduced in 3 dB steps
  - reduced in 5 dB steps



# Limits of human hearing



Fletcher &  
Munson  
1933  
experiment





# Equal loudness contours

