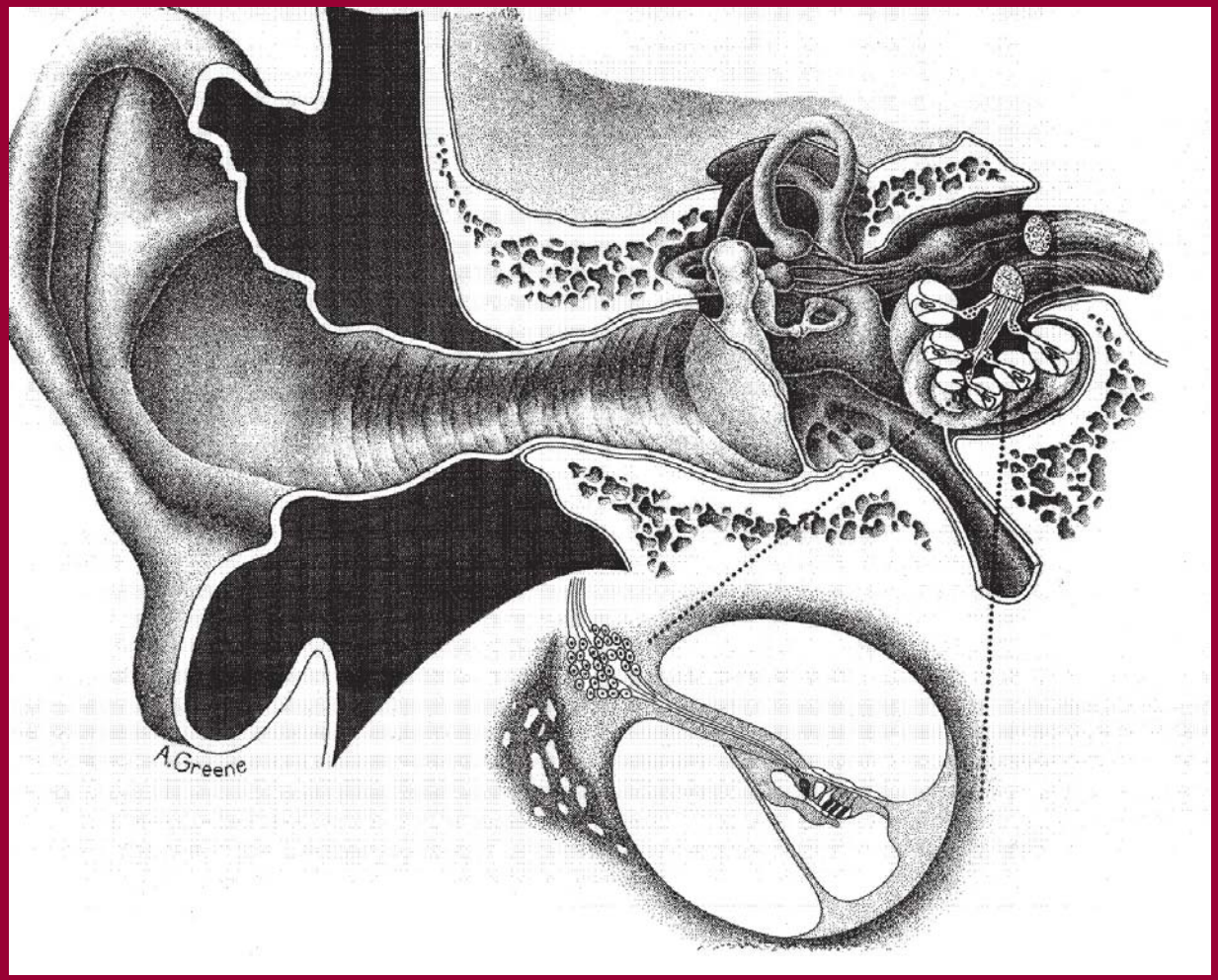
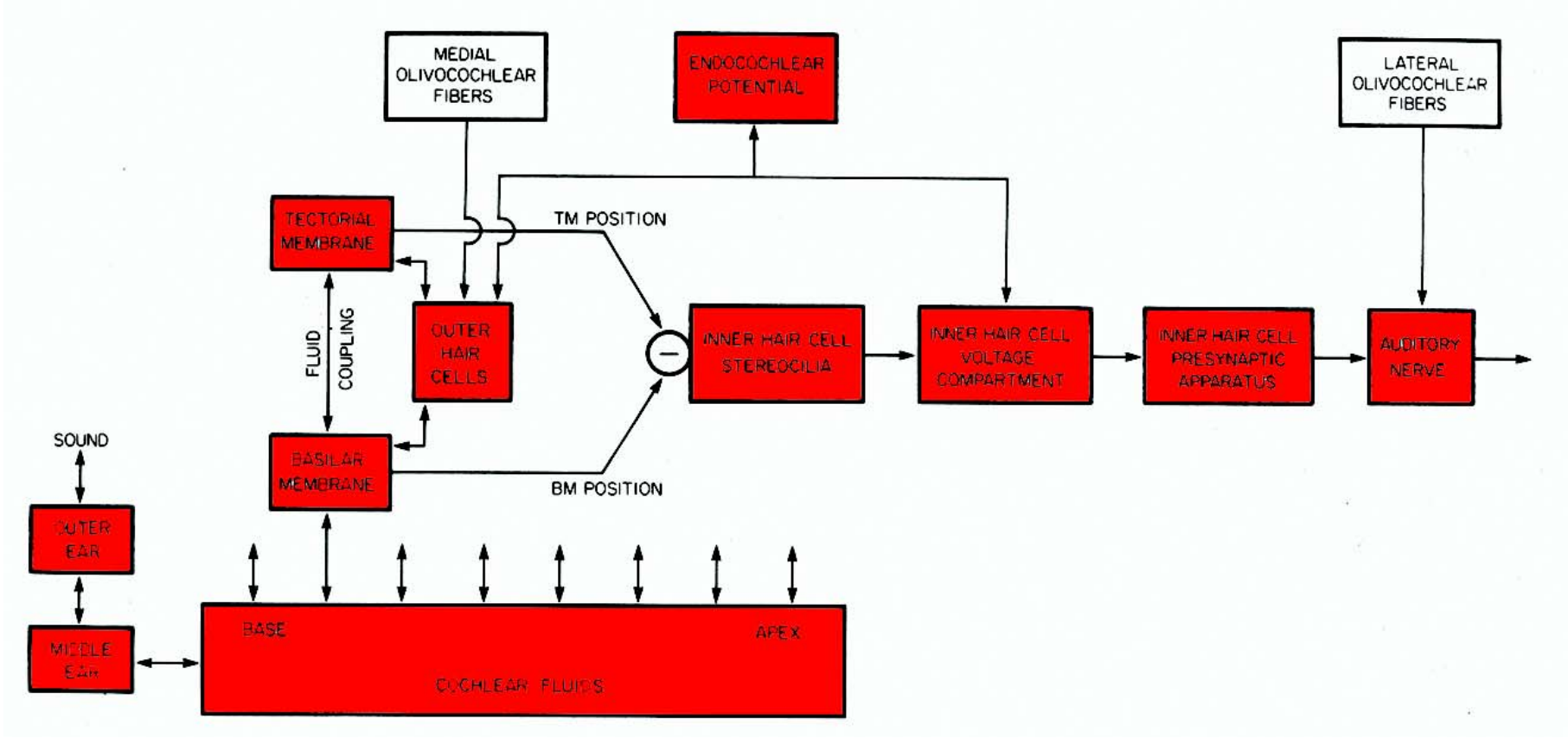
HST 721 Mouse Lab:
Noninvasive Assessment of Cochlear Function



ABRs vs. DPOAEs

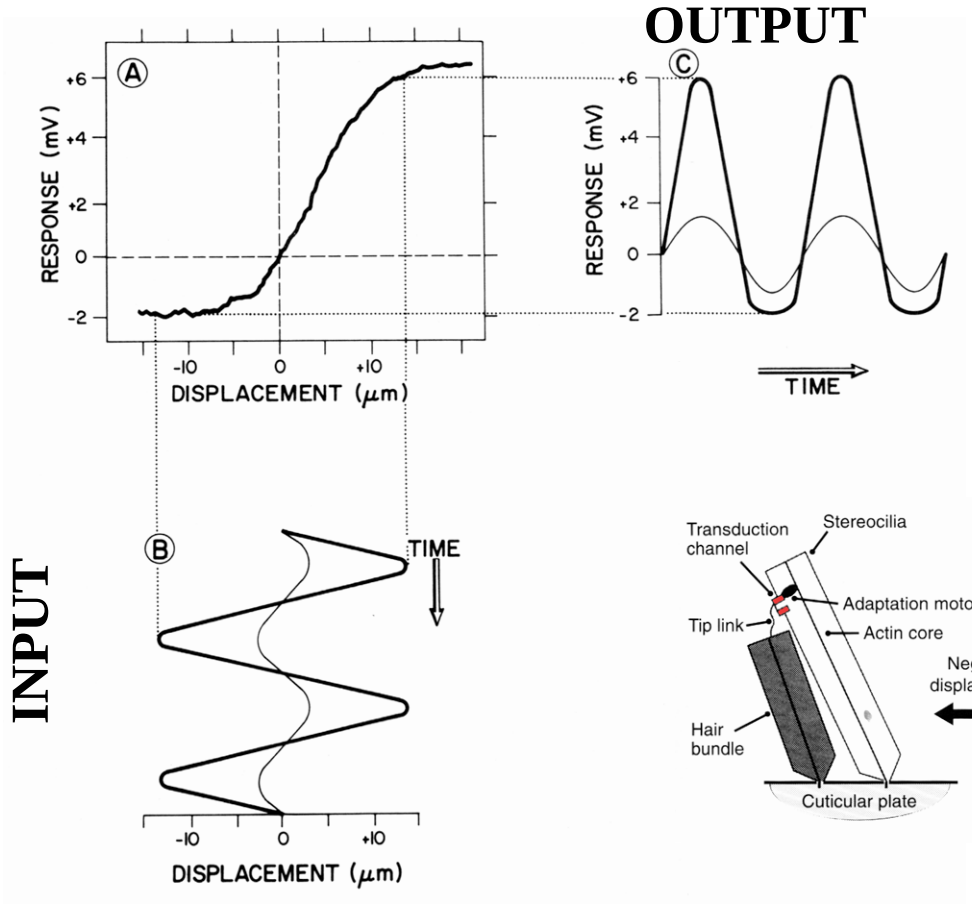
ABRs assess all structures

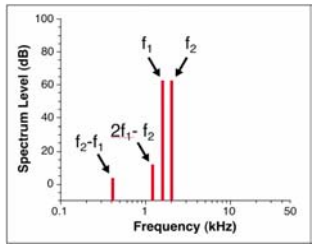


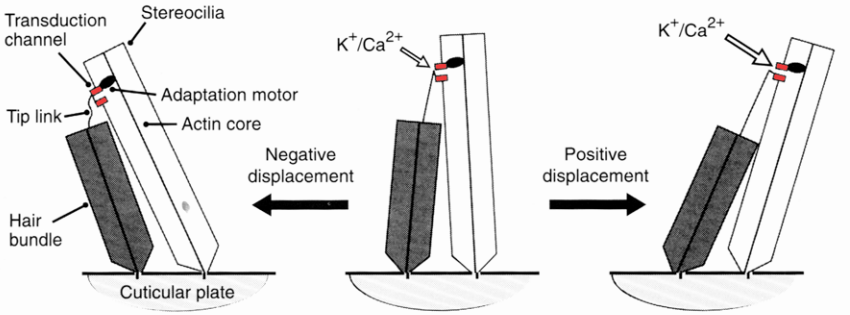
DPOAEs:

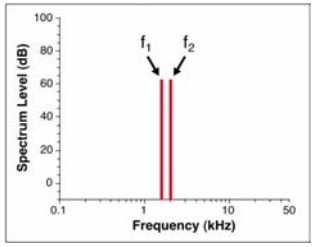
Distortion Product Otoacoustic Emissions

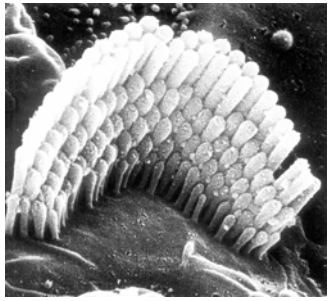
DPOAEs: Source of the Nonlinearity



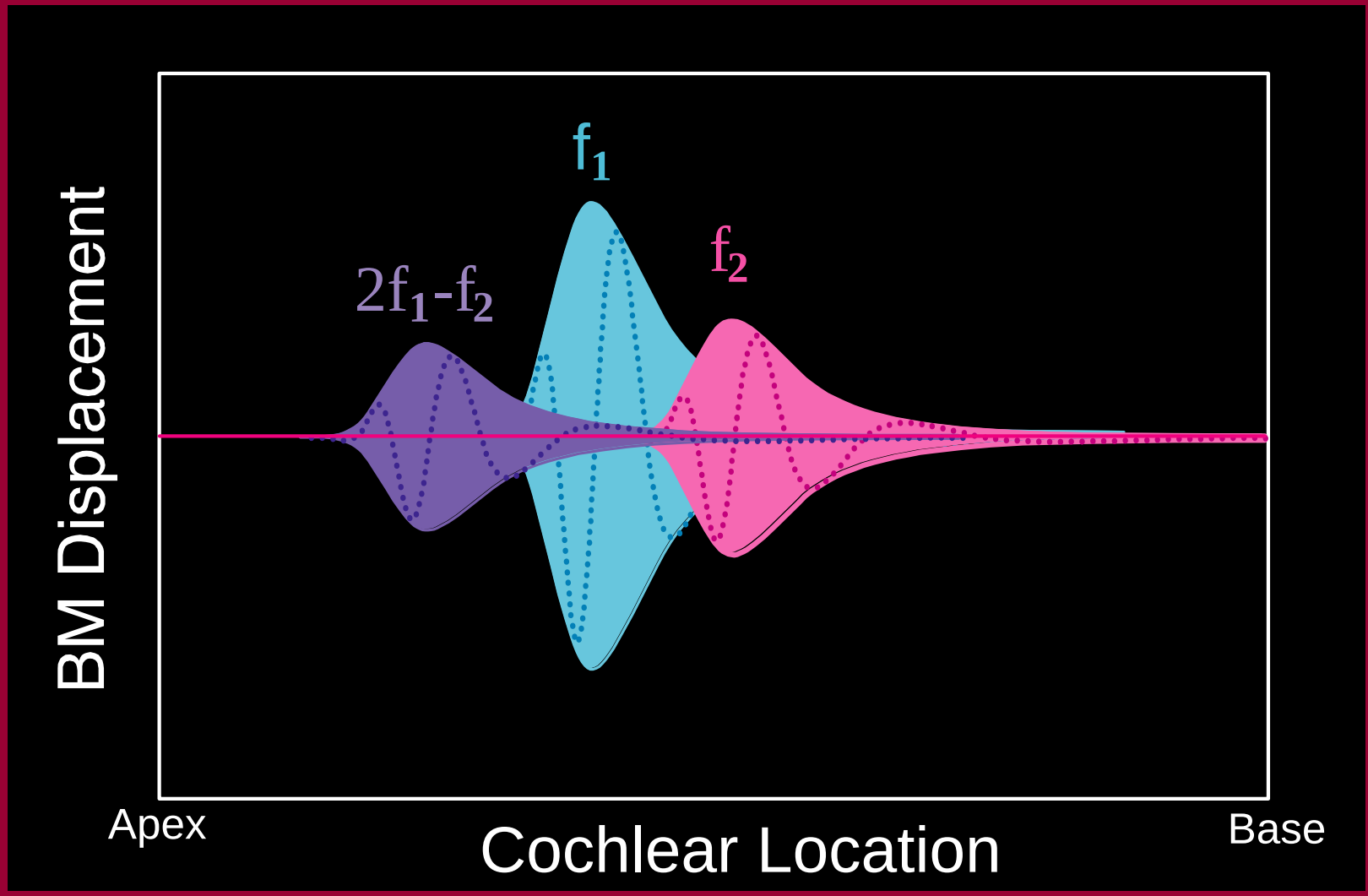




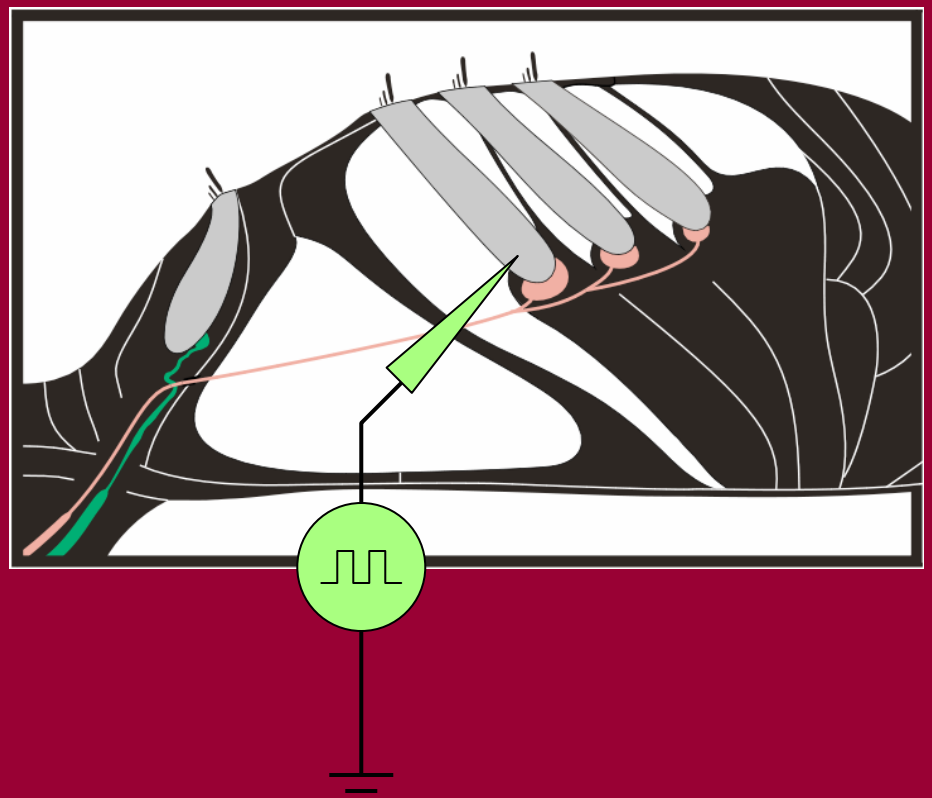




DPOAEs: Place of cochlear generation

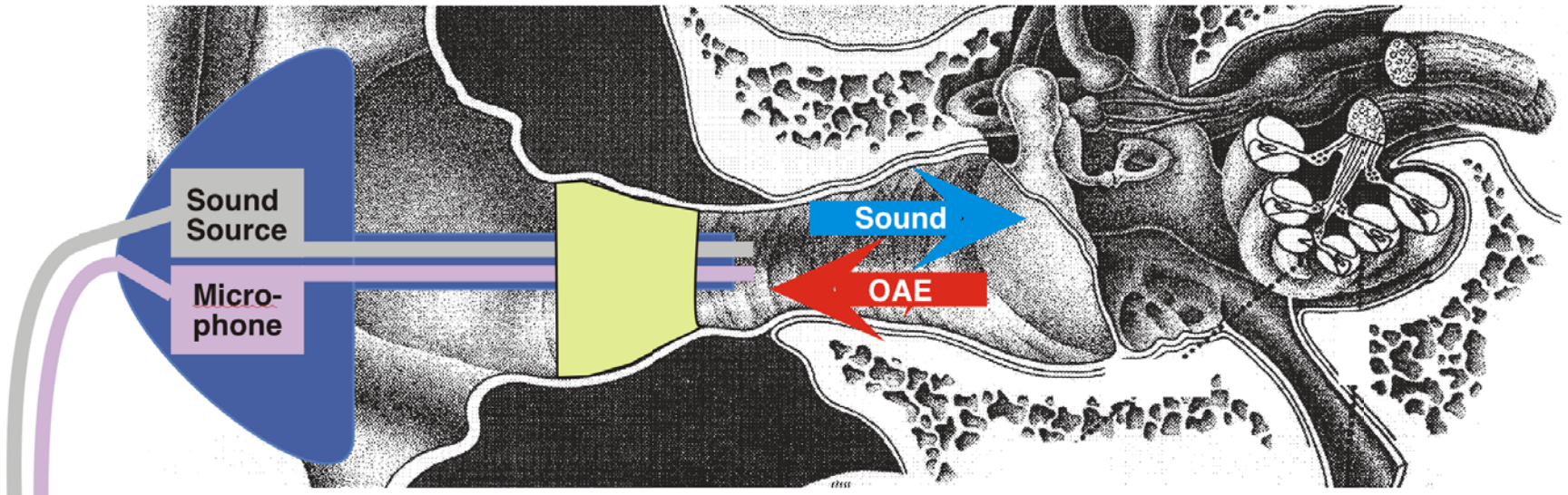


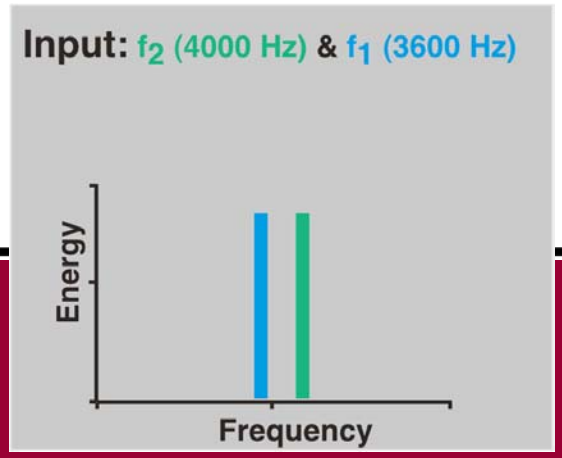
DPOAEs: Source of Amplification

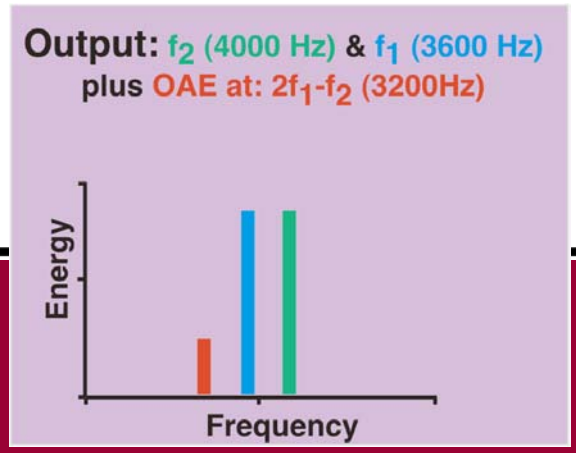


QuickTime™ and a YUV420 codec decompressor are needed to see this picture.

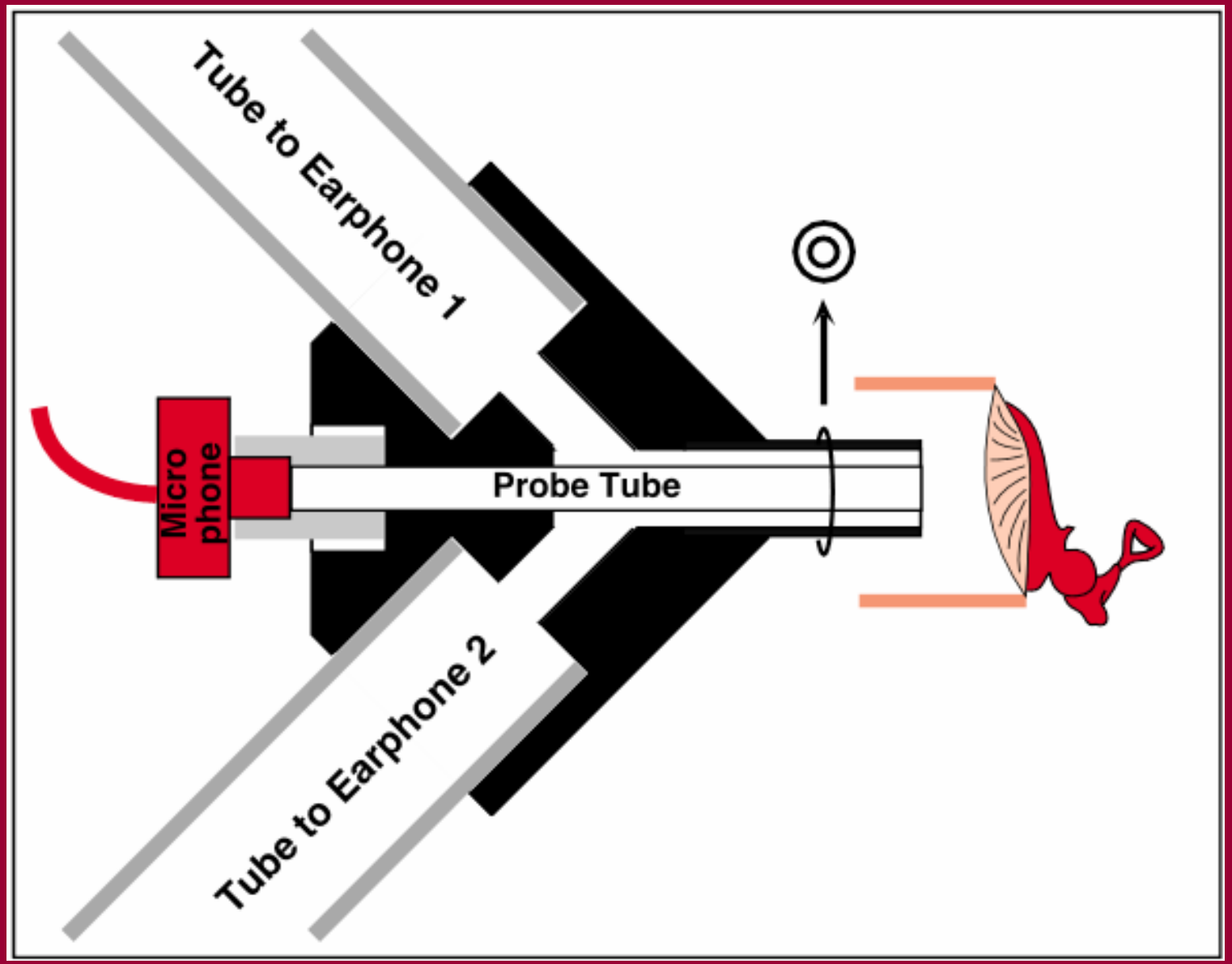
DPOAEs: How they are measured in humans



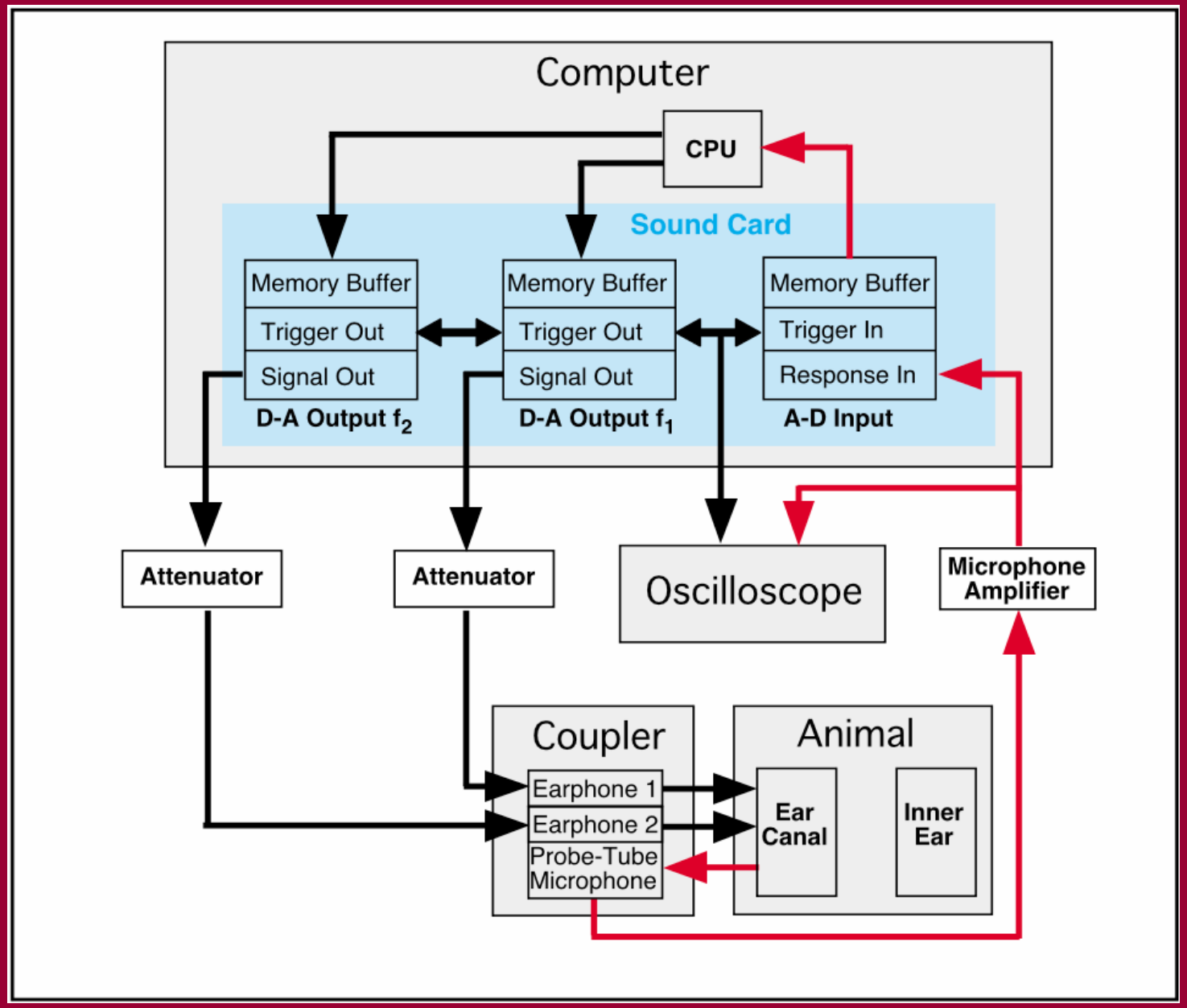




DPOAEs: How they are measured in the lab

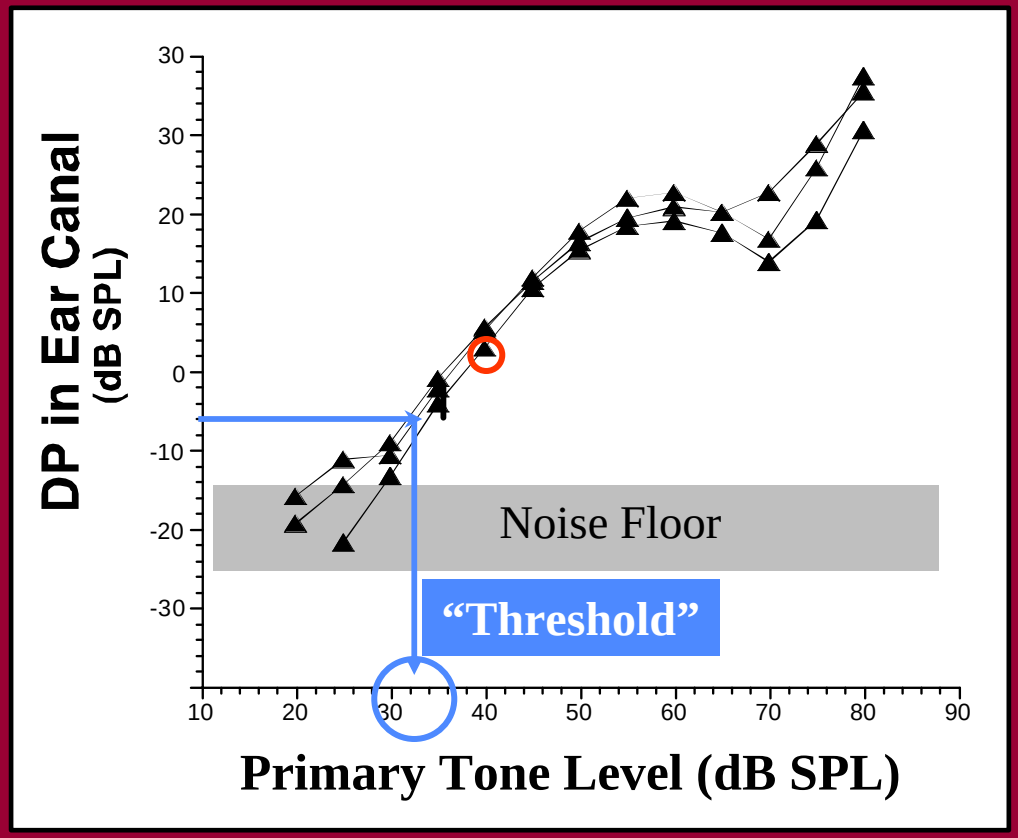


DPOAEs: How they are measured in the lab

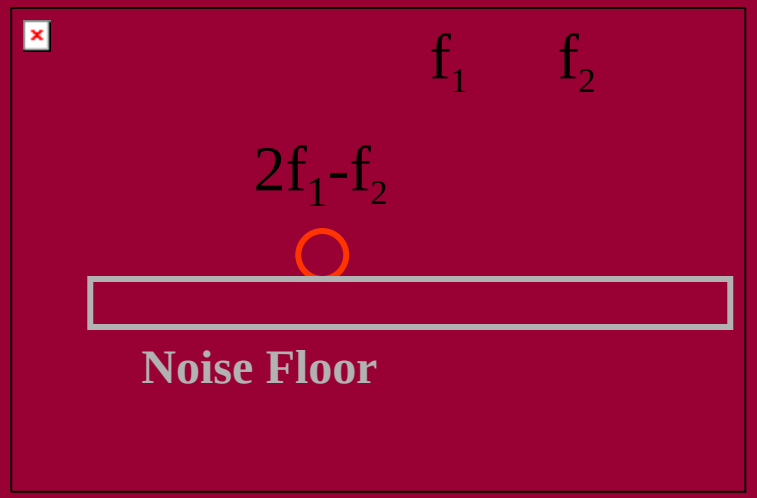


DPOAEs: What you will see in mice

DP amplitude vs. level functions in 3 ears
1 pair of primaries at many SPLs

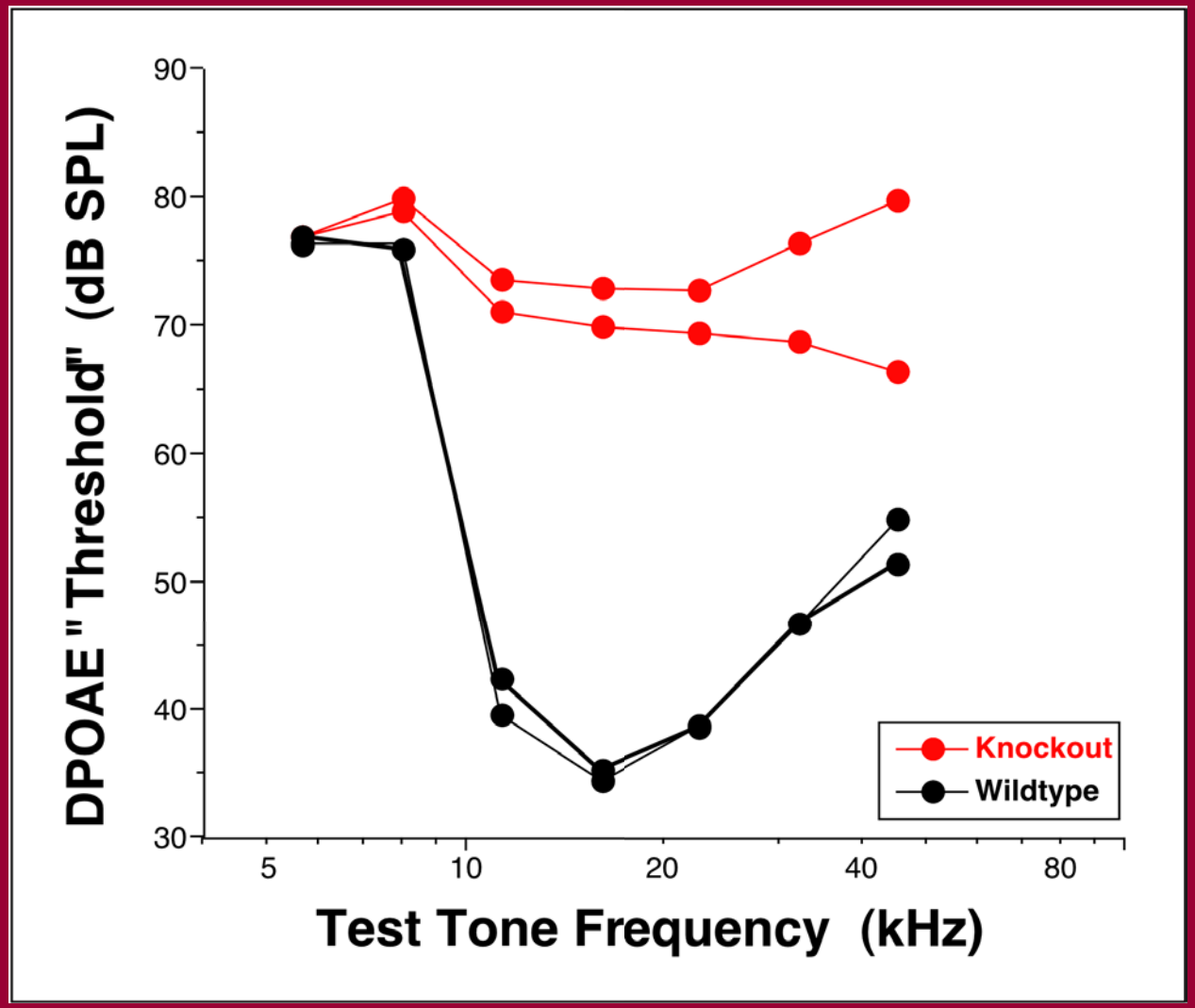


Ear-canal spectrum for 1 pair of primaries at 1 SPL

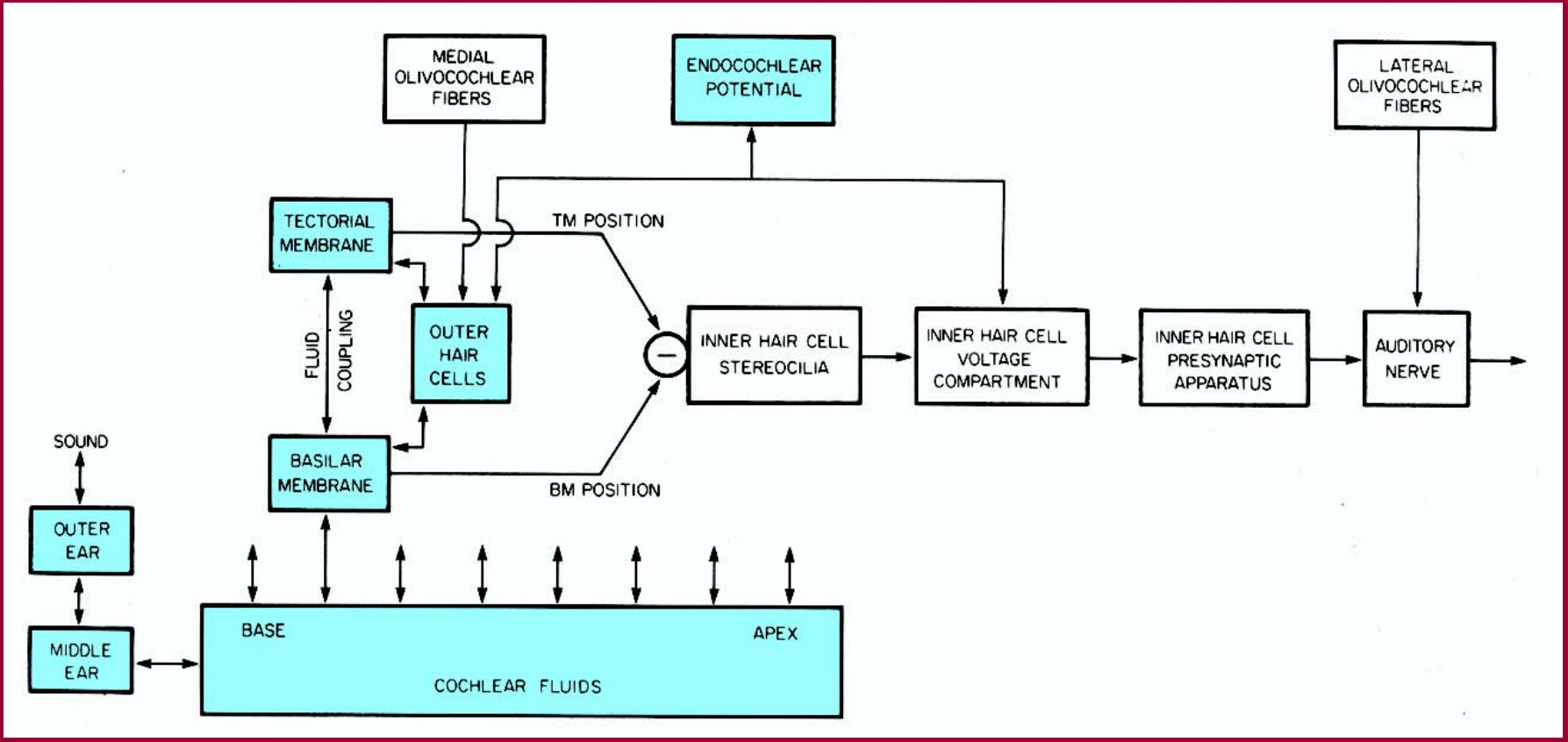


DPOAEs: What you can compute in mice

DP iso-response functions
"Threshold" vs frequency



DPOAEs: Assess OHCs and all “upstream elements”

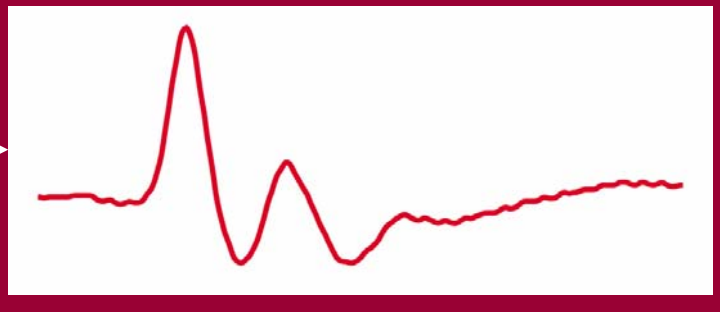


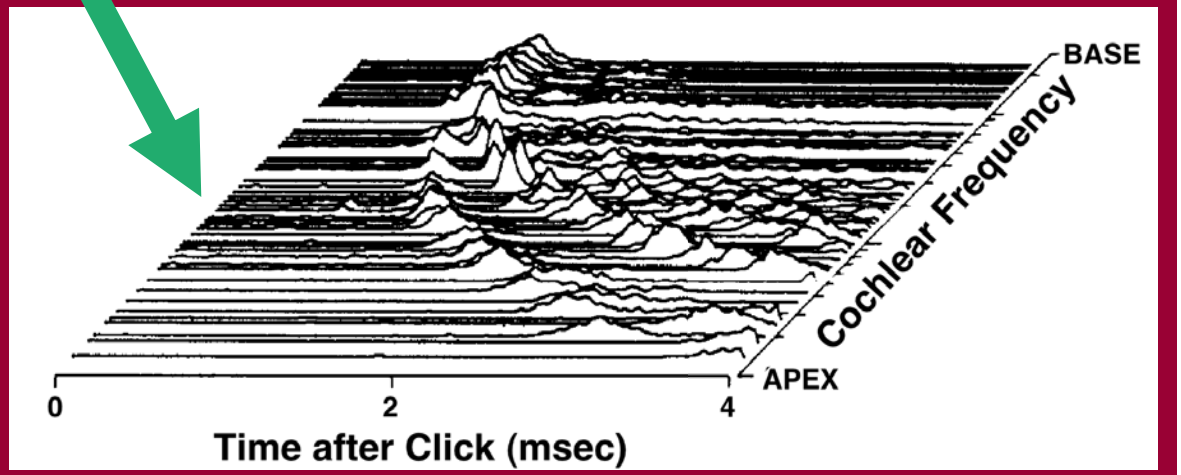
ABRs:
Auditory Brainstem Responses

CAPs: Dominated by auditory nerve response

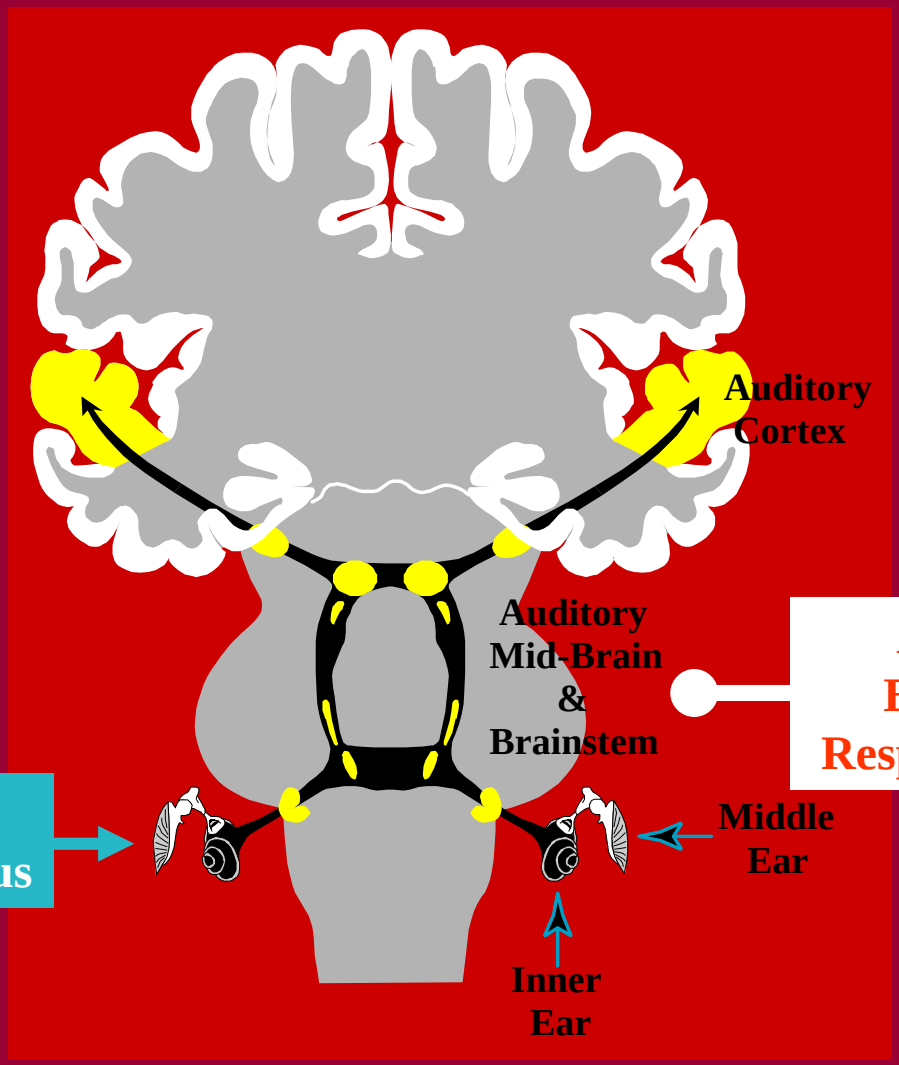
Click Stimulus

Compound Action Potential (CAP)



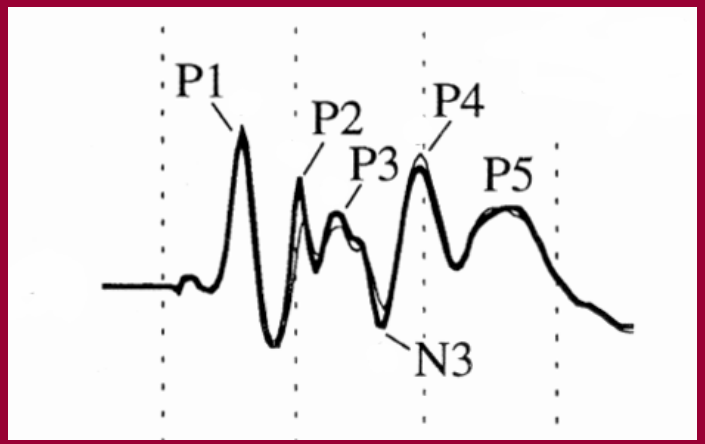


ABRs: Include potentials from several brainstem nuclei

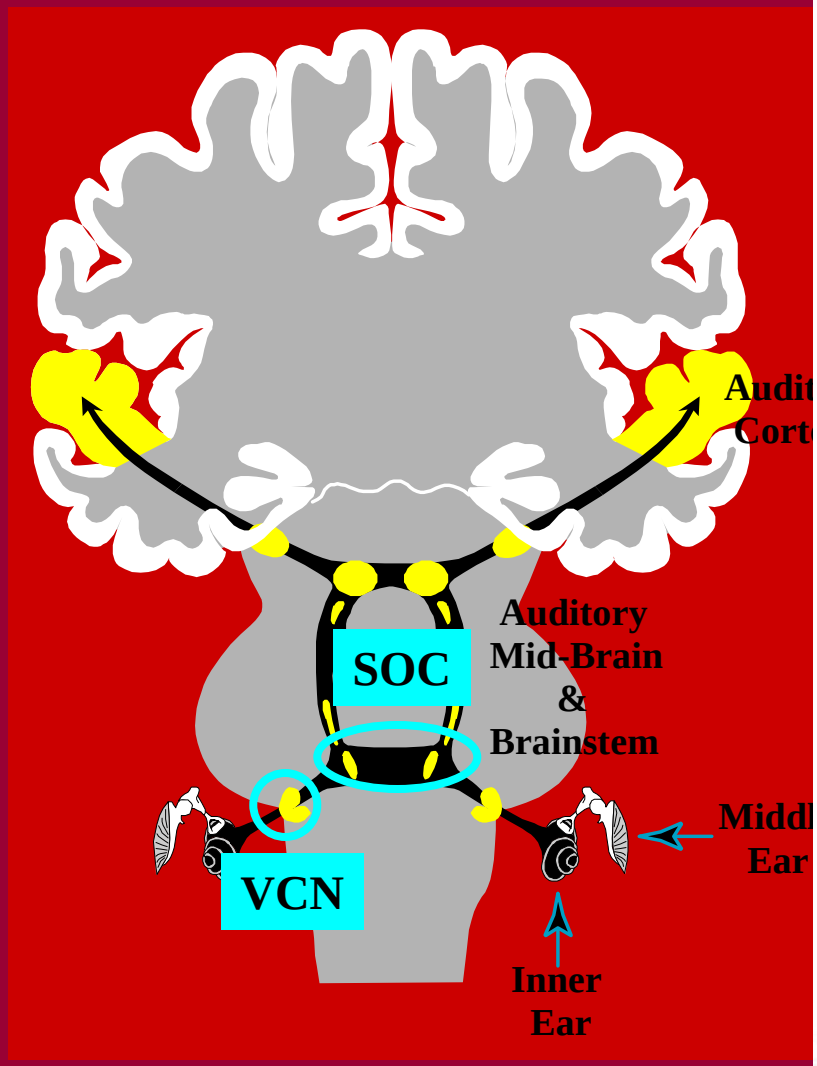


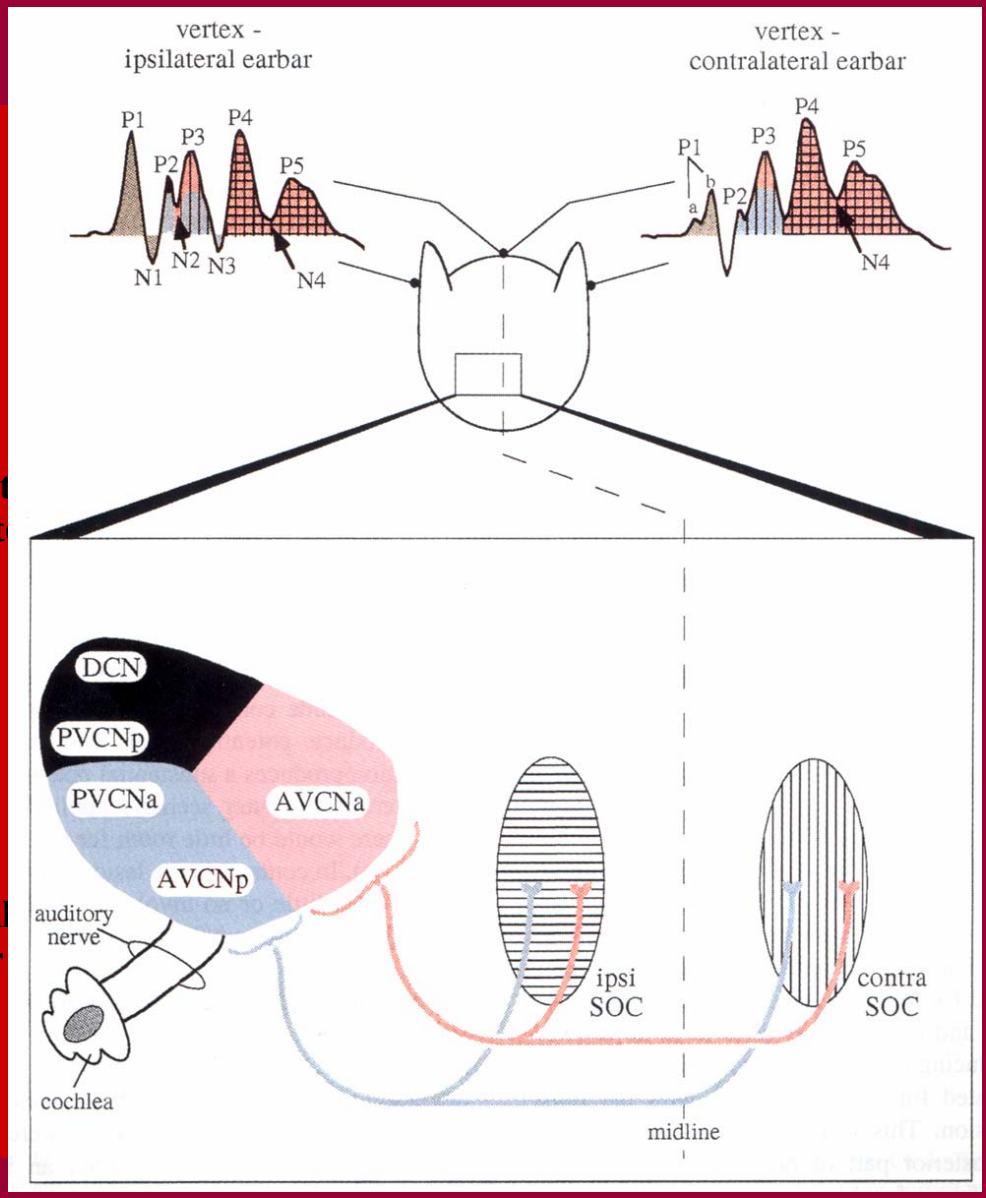
Click Stimulus

Auditory Brainstem Response (ABR)

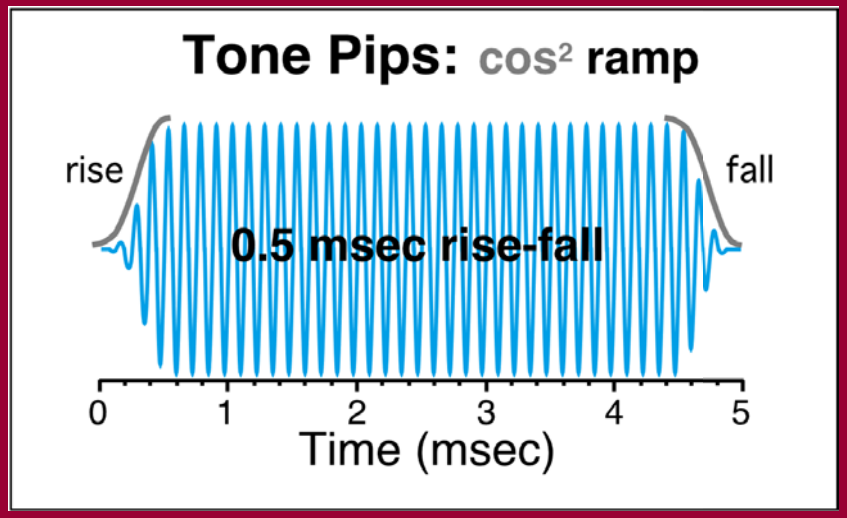


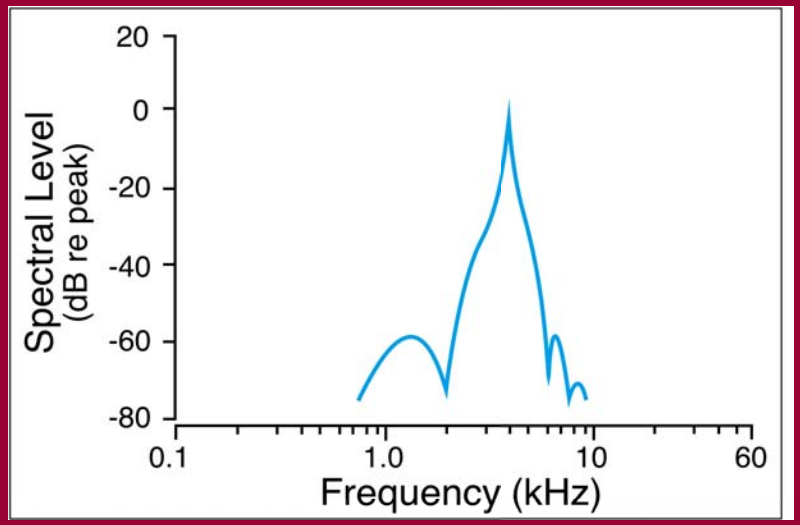
ABRs: Which cells dominate the peaks ?

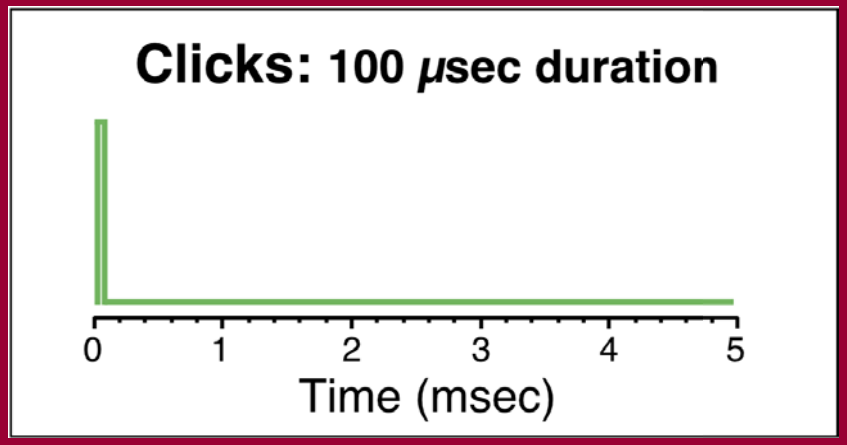


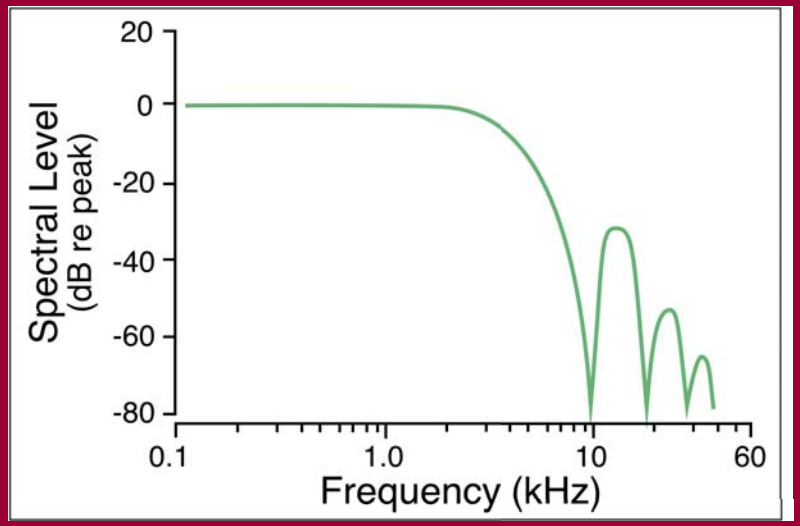


ABRs: Tone pips vs. Clicks

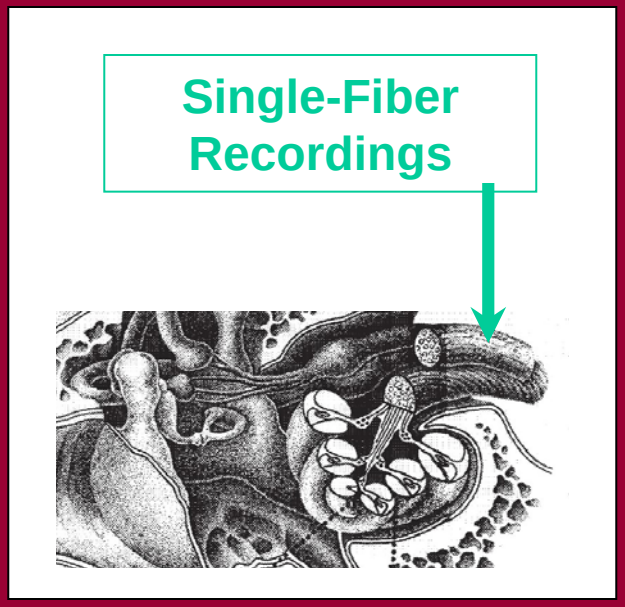


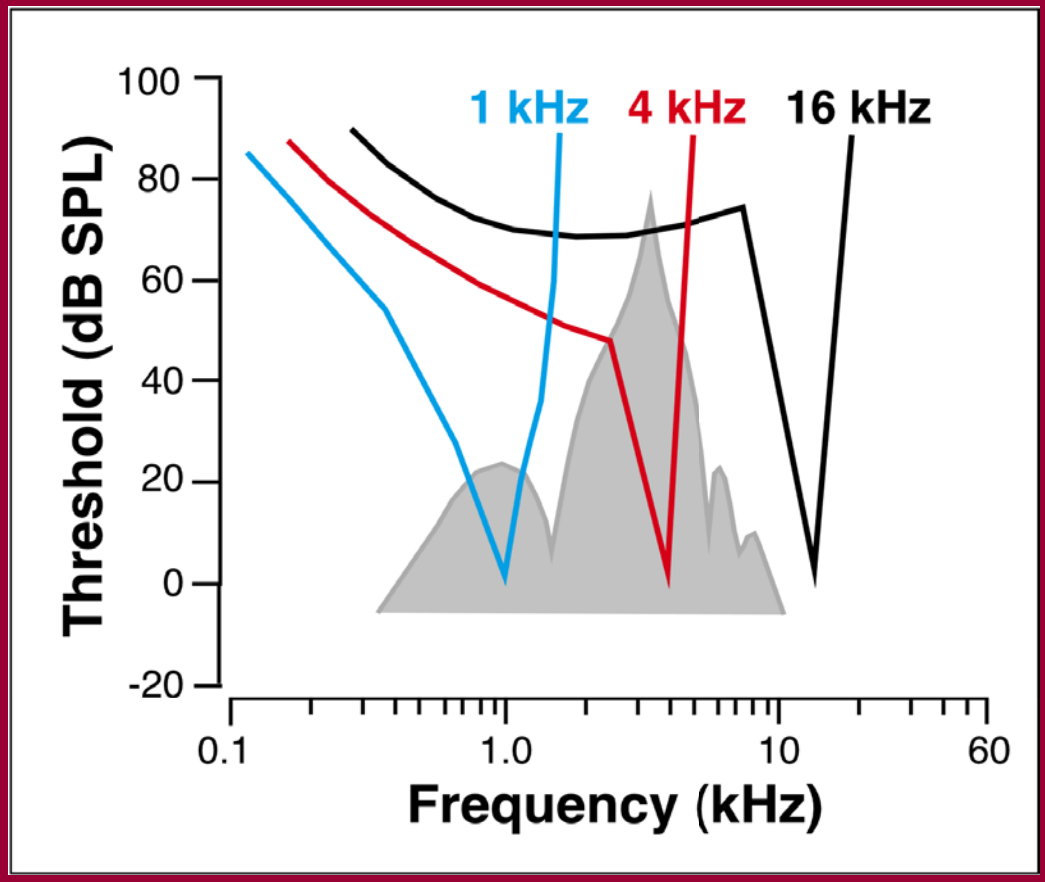




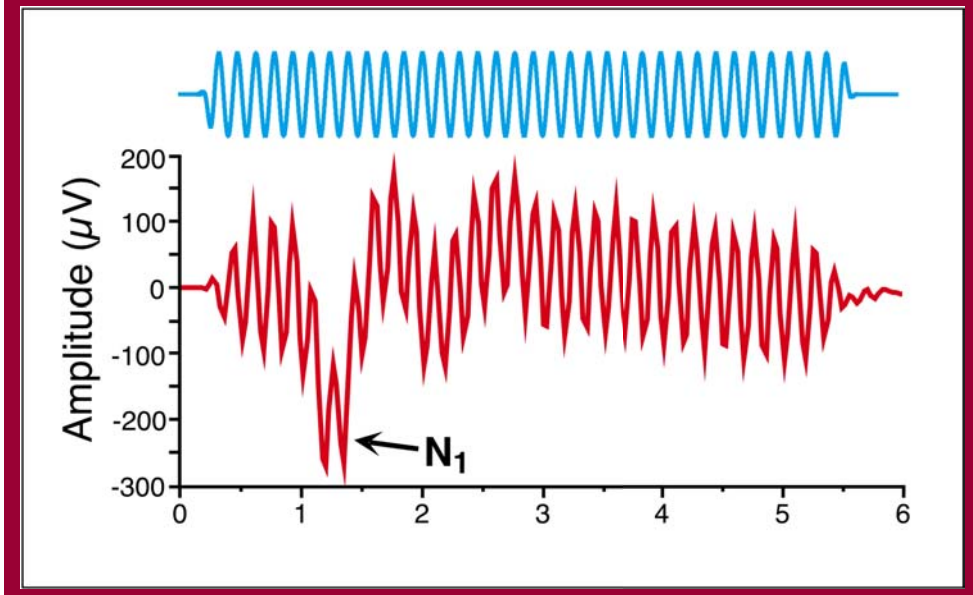


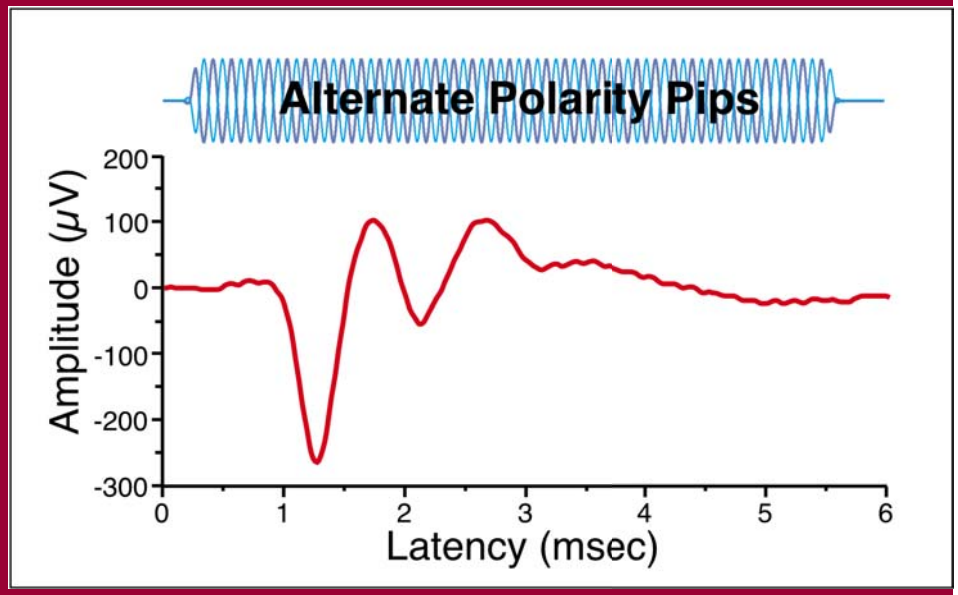
ABRs: Frequency selectivity of tone pips

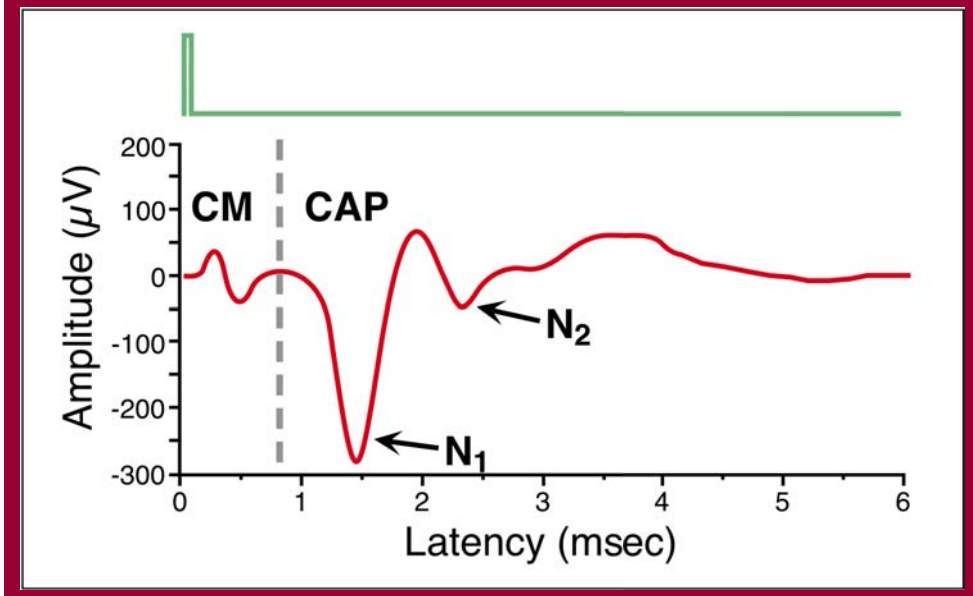


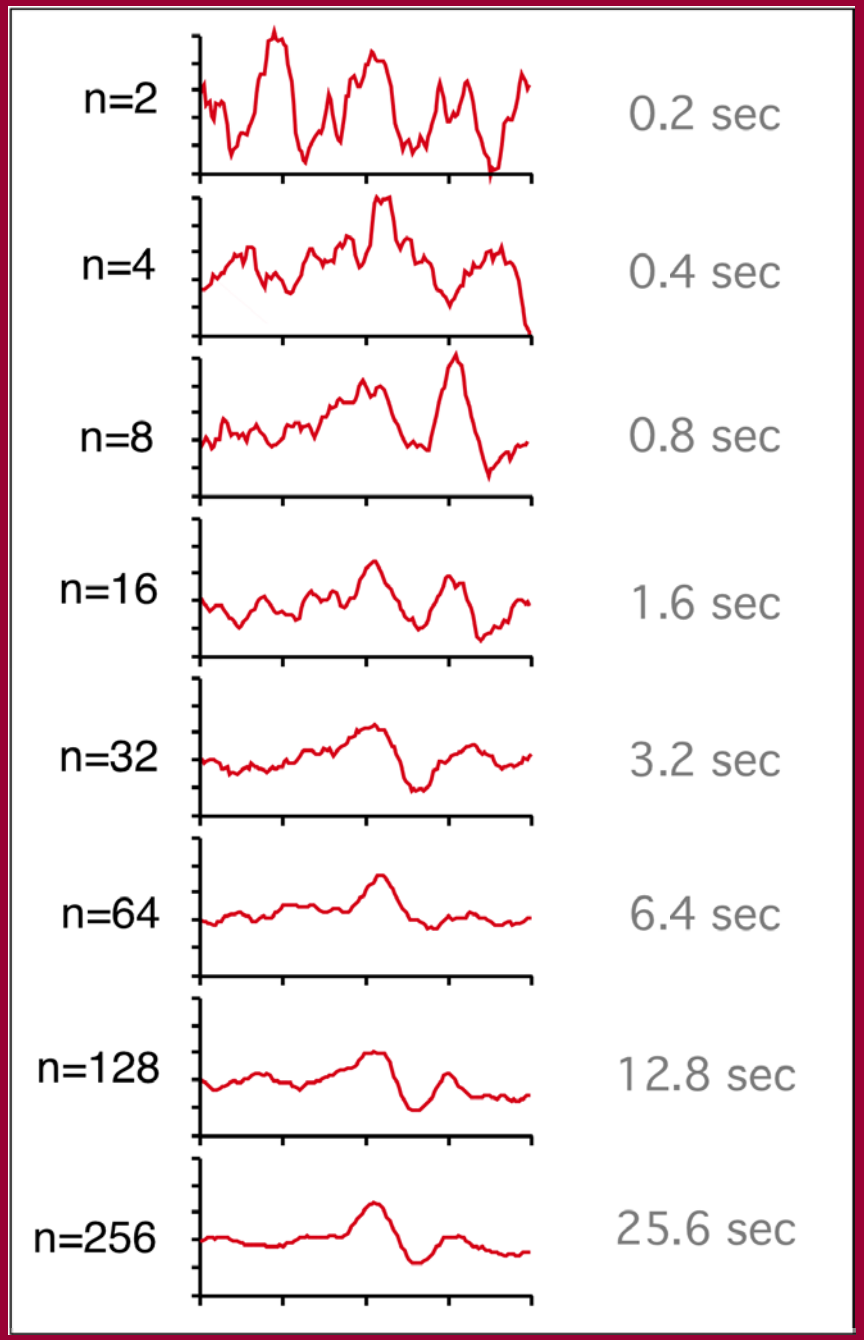


ABRs: Tone pips vs. Clicks







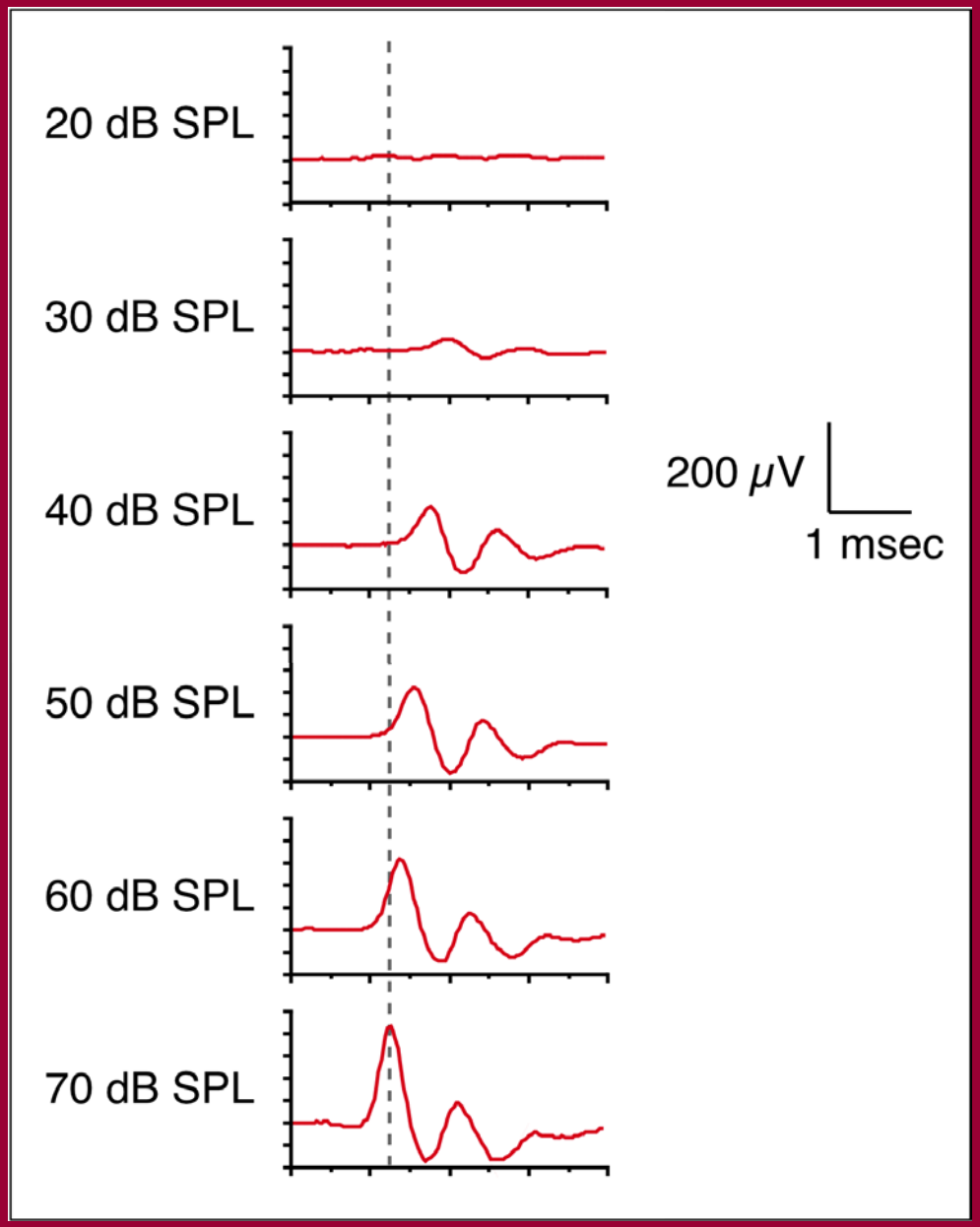


ABRs: Signal Averaging

Noise decreases in proportion to $\sqrt{n}$, where n = # averages

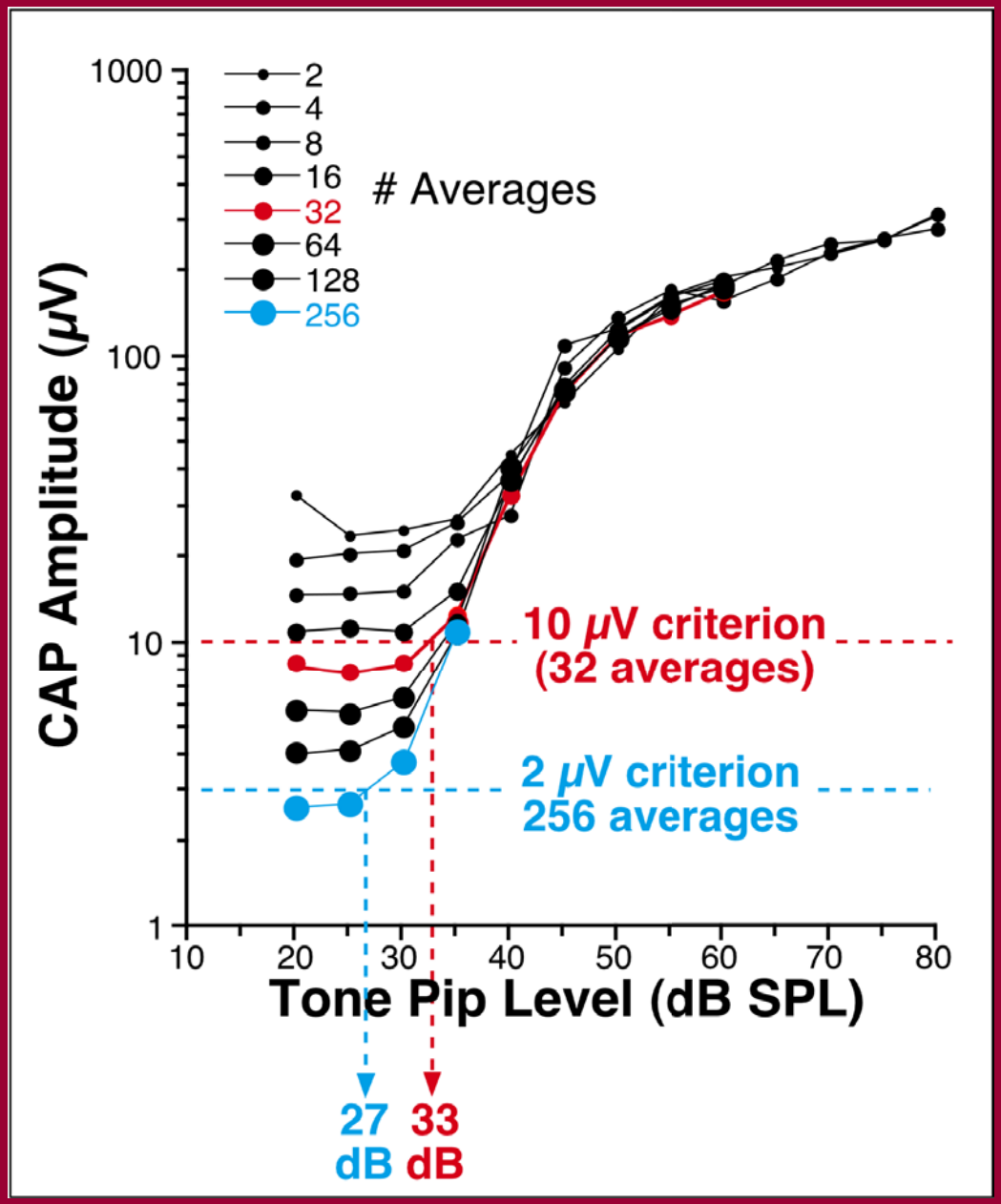
Near threshold, 1024 averages are typically acquired for ABR.

ABRs: What is Threshold?



Response amplitude grows with increasing stimulus SPL

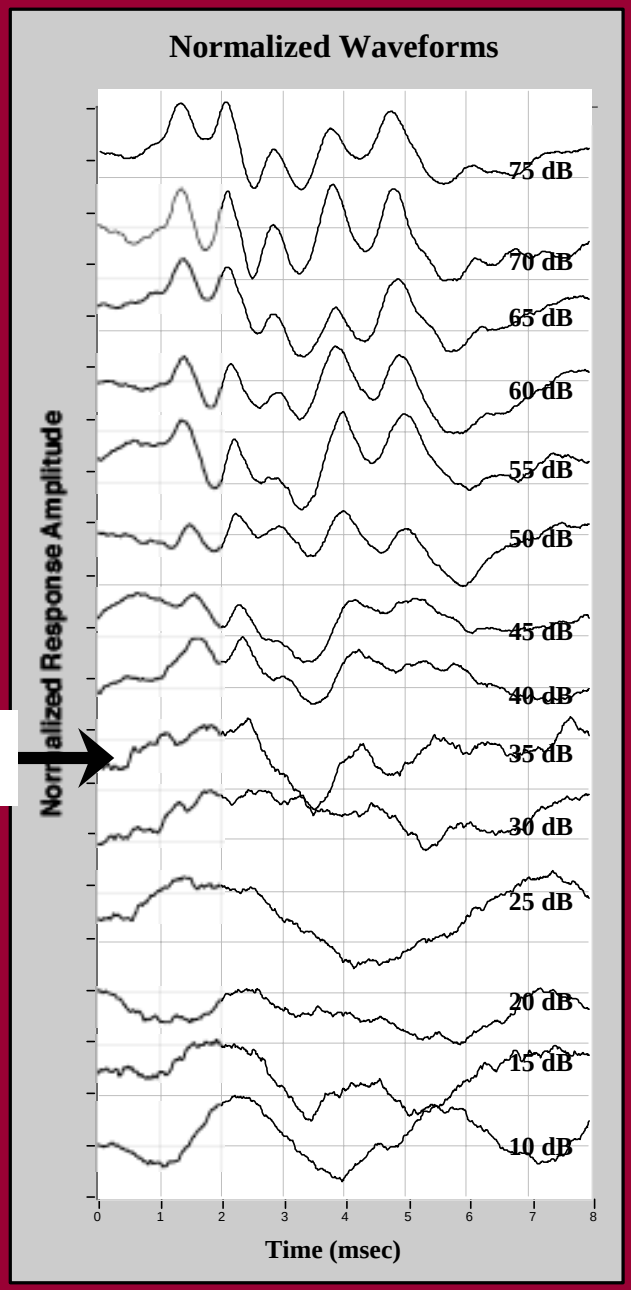
ABRs: What is Threshold?



Strategy 1:
Iso-response criteria

Noise floor, and therefore "threshold" is affected by amount of averaging

ABRs: What is Threshold?

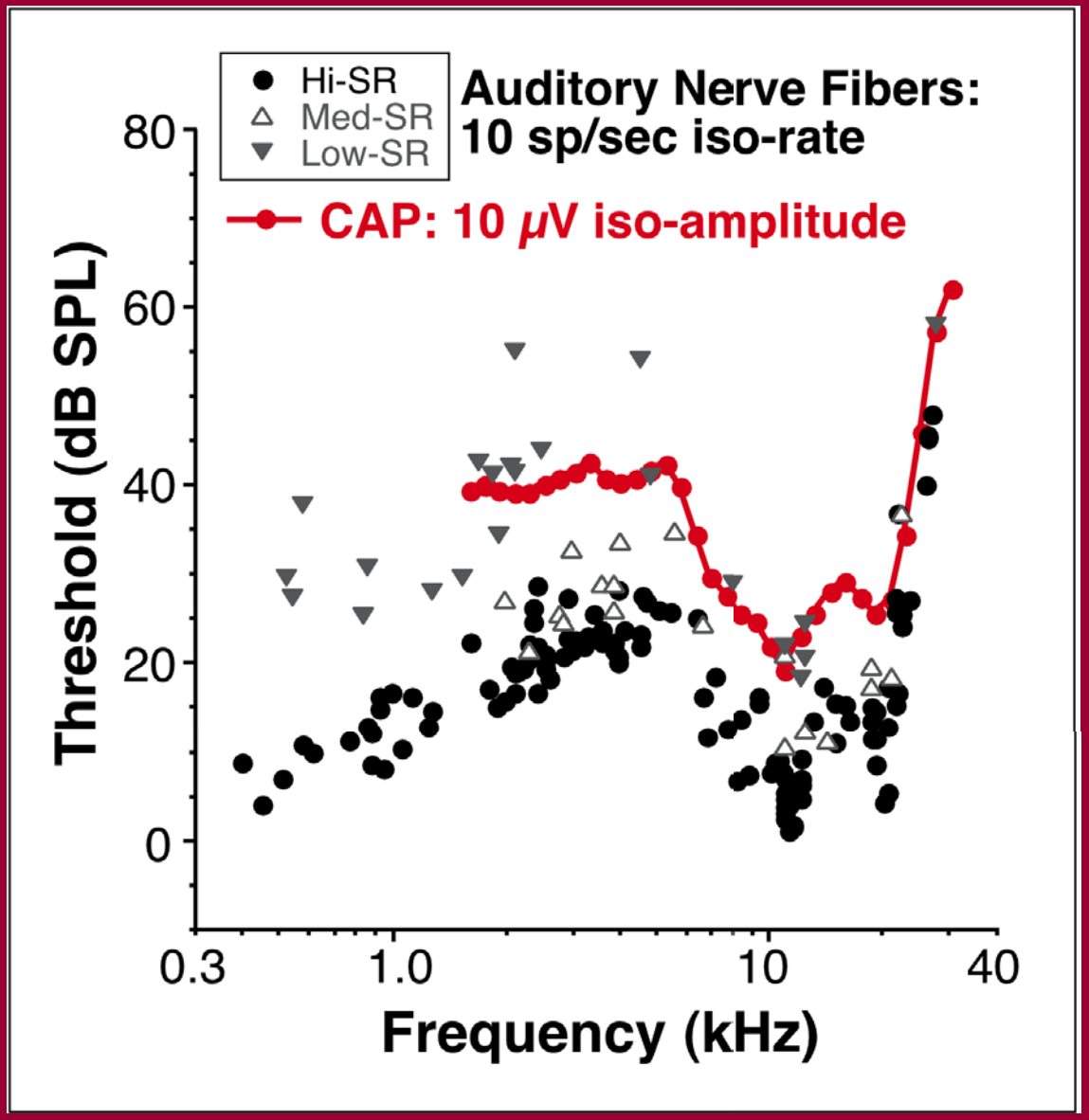


Threshold

Strategy 2:
Follow the waves

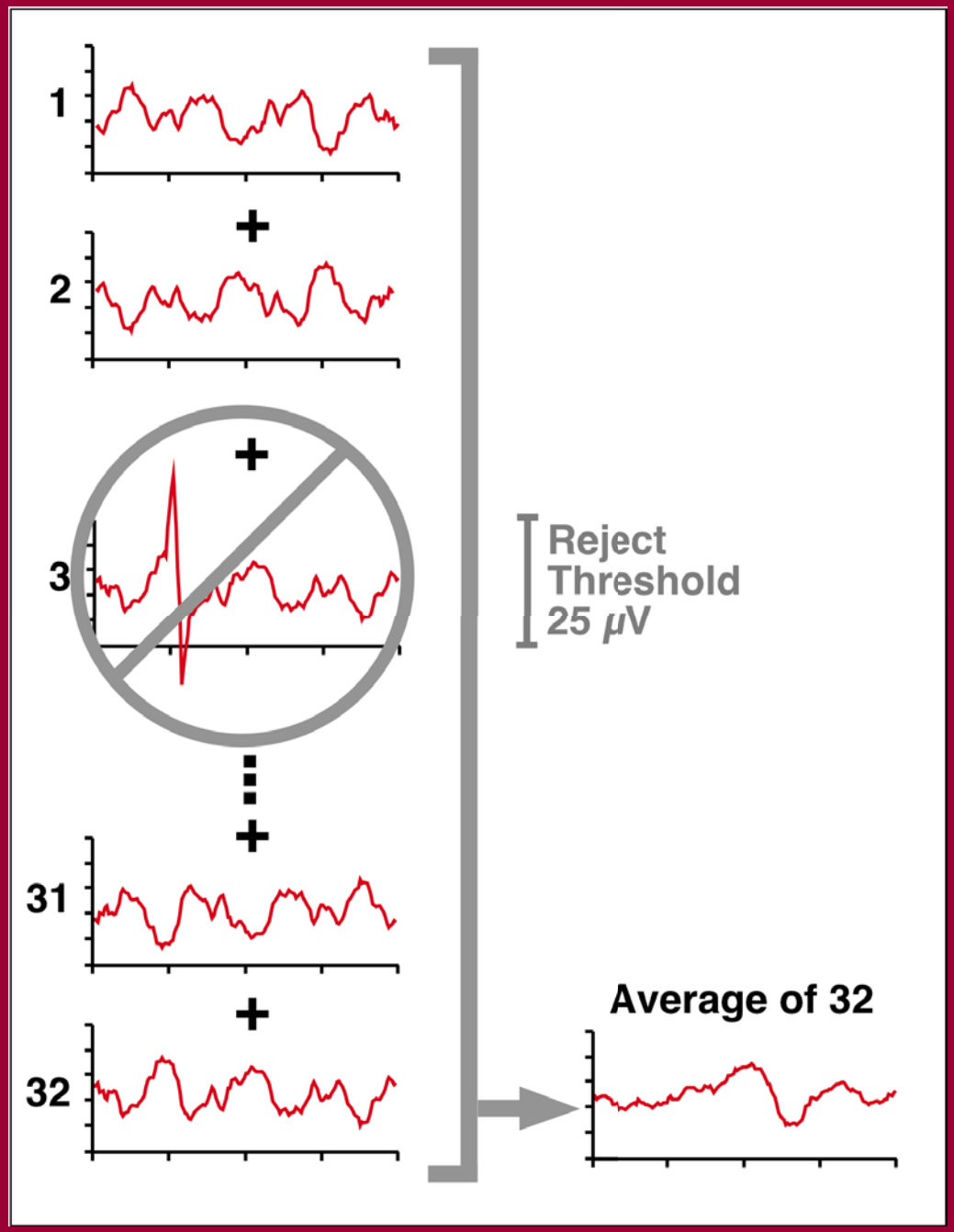
Noise floor, and therefore "threshold" is affected by amount of averaging

ABRs: What is Threshold?



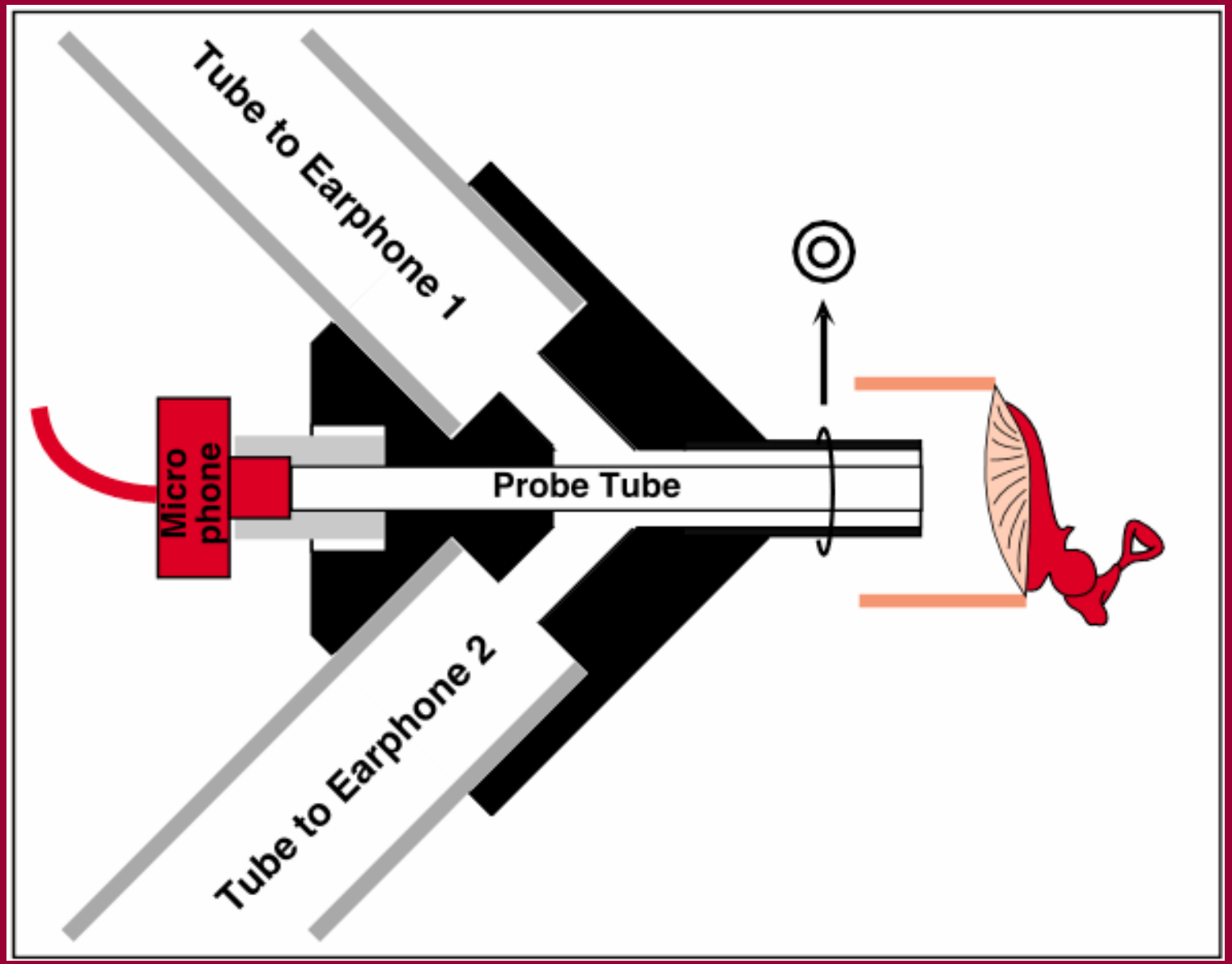
Even with extensive averaging, ABR/CAP "Threshold" is > single fiber "Threshold"

ABRs: Signal Averaging

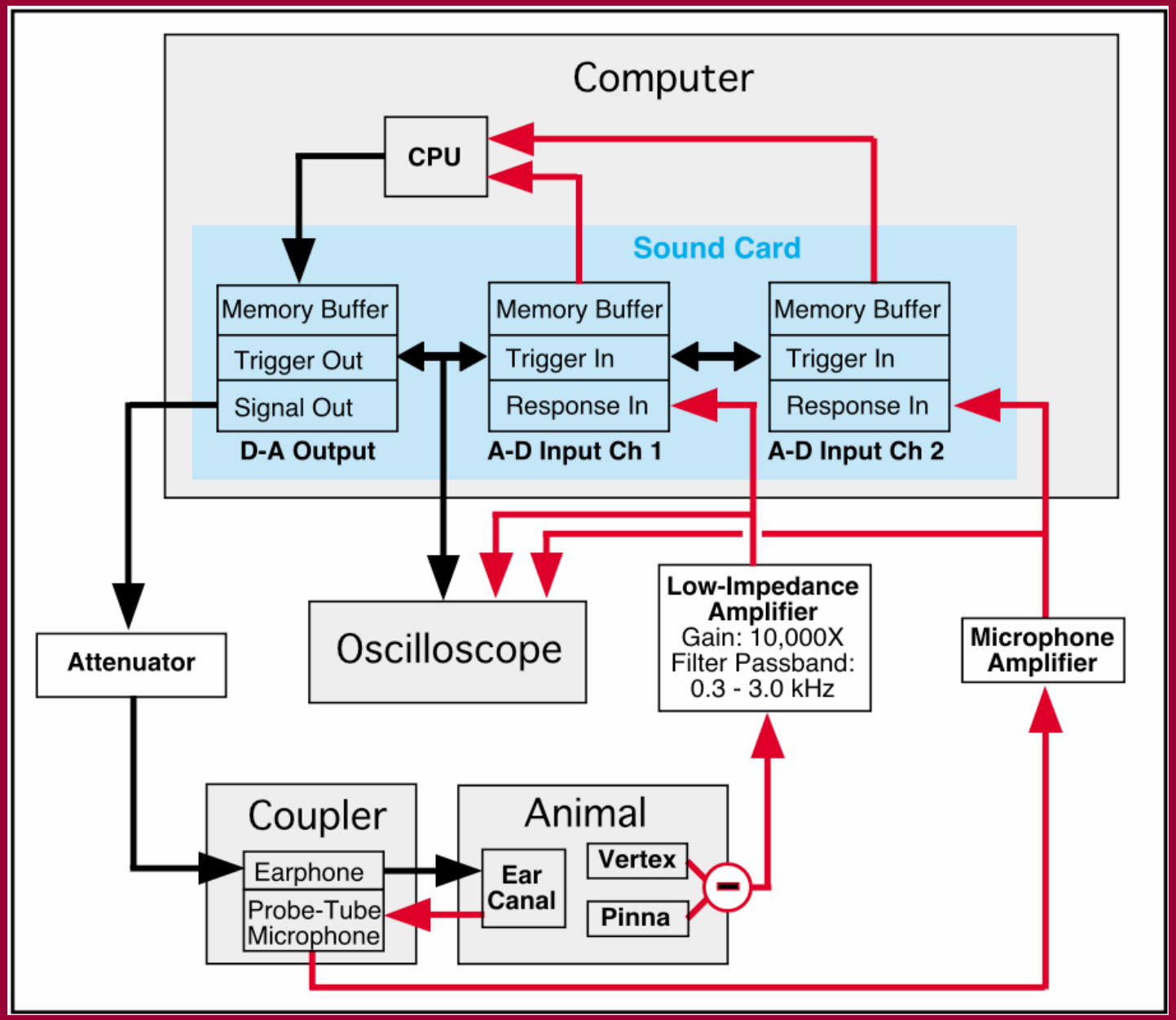


"Artifact Reject" in the software allows removal of large potentials due to EKG

ABRs: How they are measured in the lab

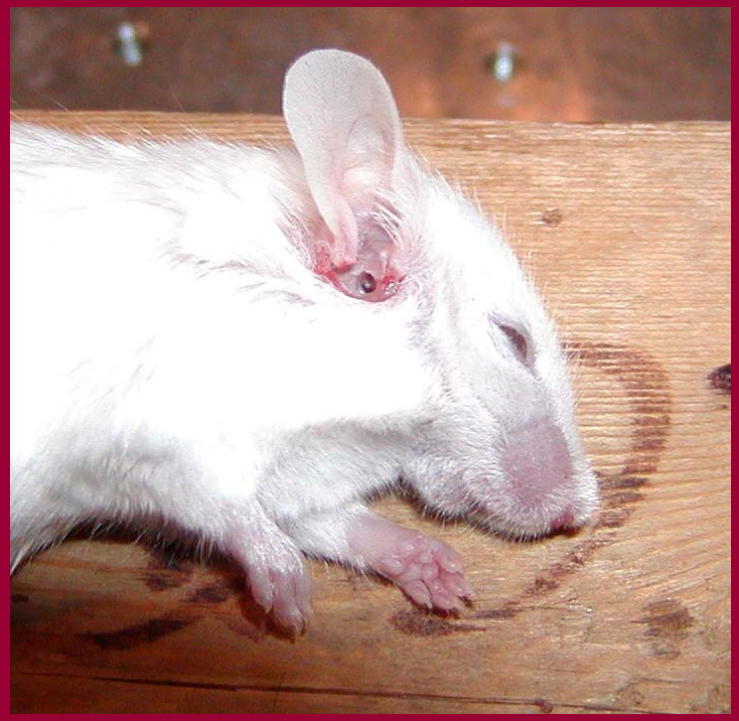


ABRs: How they are measured in the lab

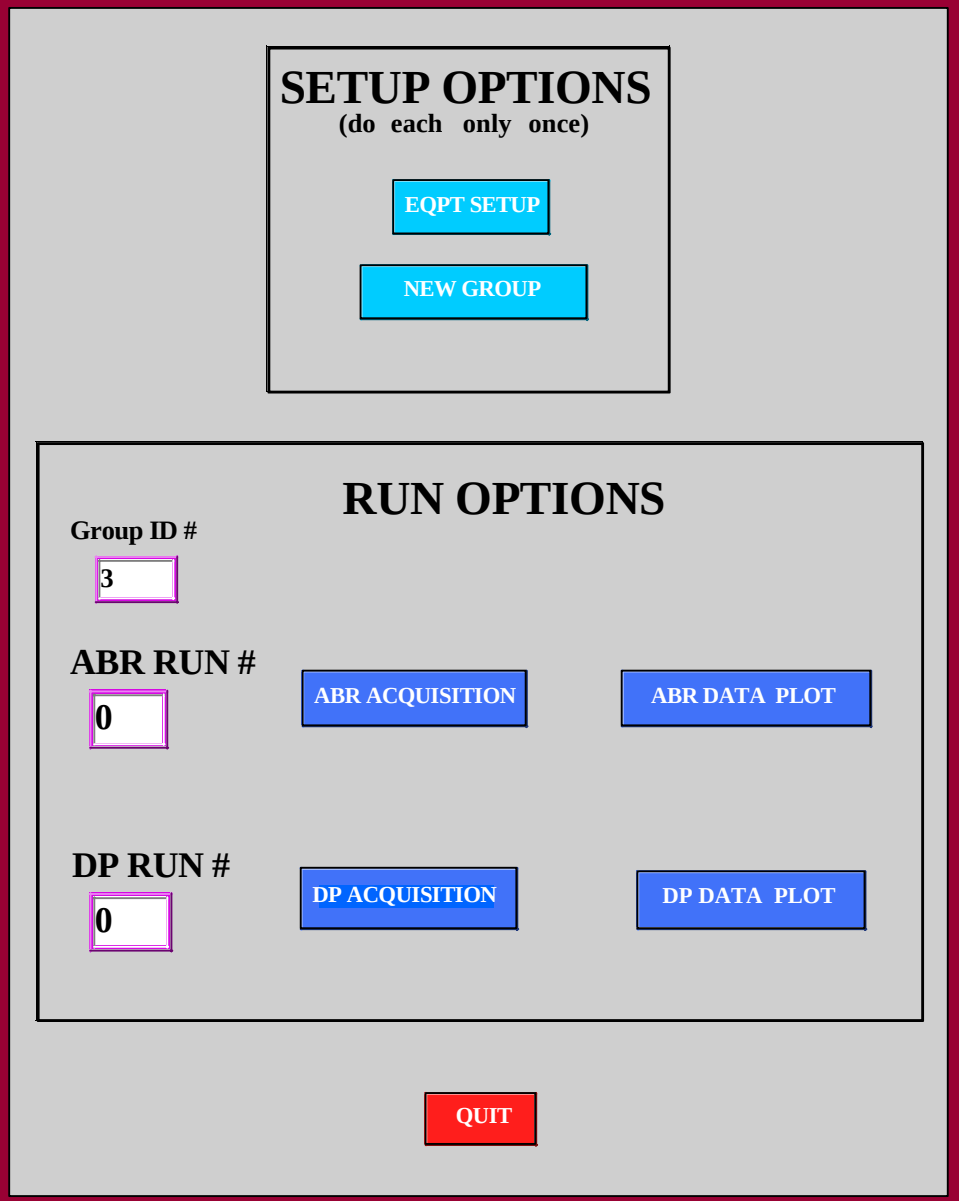


ABRs and DPOAEs:
The Laboratory

Ear Canal Surgery

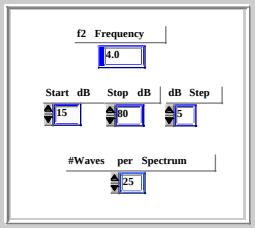


LabVIEW Software Controller: Main Menu



Software Controller: DPOAE Control & Indicators

1. Set Stimuli



2. Start — START

3. Watch Data Acquisition →

ABORT

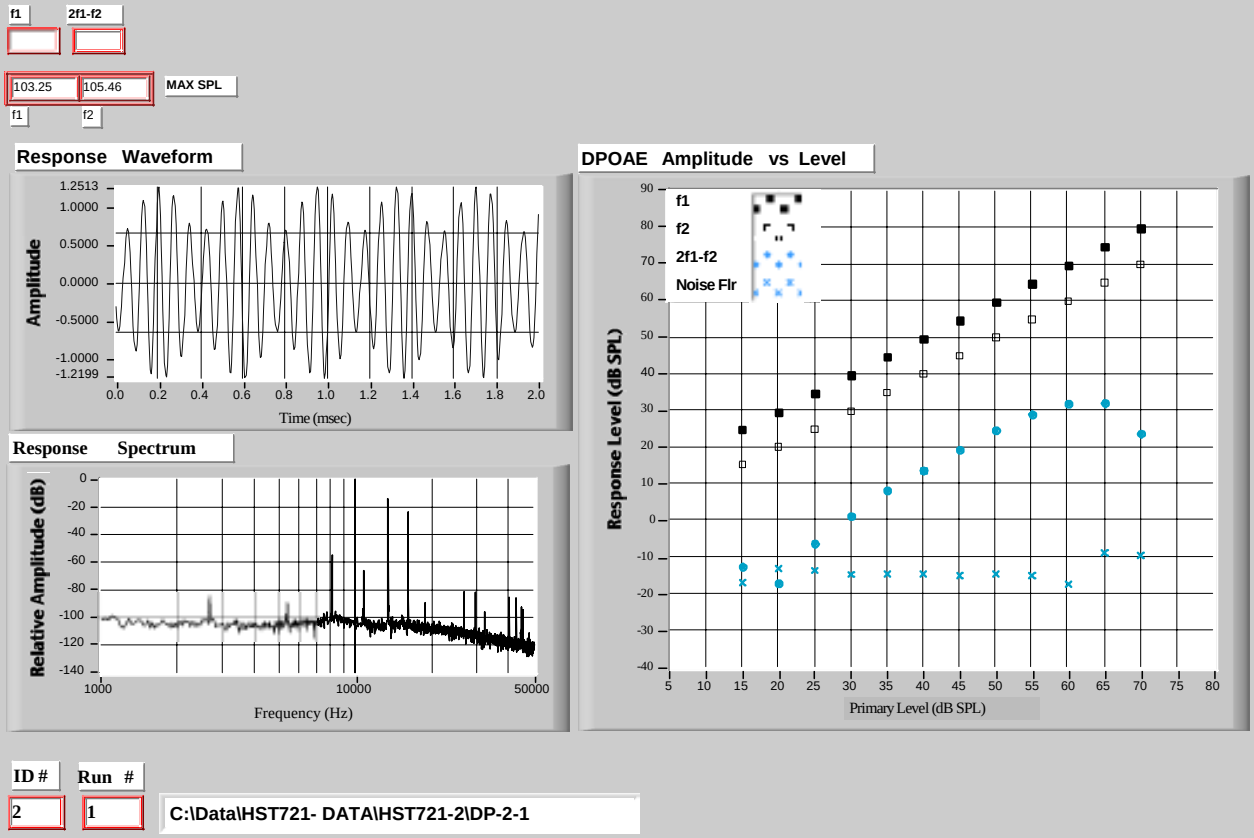
4. Add Notes (Optional)

Type stuff here if you want

5. Save — SAVE DATA

6. Note FilePath →

7. Return to Main Menu — RETURN



Software Controller: Data Storage

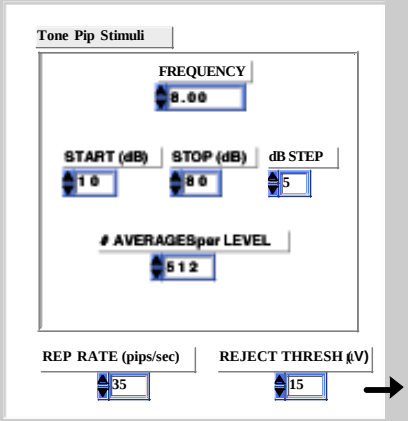
```
:RUN-1    DP I-O     3:54 PM:Level Step (dB):5          Start dB: 20          Stop dB: 50
          # Buffers Averaged: 25Sampling Interval:4     Ear:Right
:NOTES-
:CHAMBER-4

:ANALYZED DATA
:Command dB  Measured f1(dB)  Measured f2(dB)  2f1-f2(dB) 2f1-f2Nse(dB)
 20.00       30.01       19.97       -24.01      -25.33
 25.00       35.05       24.98       -26.75      -23.71
 30.00       40.04       30.01       -25.80      -25.42
 35.00       45.04       35.01       -25.51      -24.86
 40.00       50.04       40.04       -22.93      -25.06
 45.00       55.11       45.05       -20.88      -24.54
 50.00       60.10       50.05       -23.63      -24.94

:RAW WAVEFORMS
0.002390   0.003187   0.004161   0.006183   0.009836   0.016199   0.027711
0.002397   0.003308   0.004397   0.006392   0.010246   0.016801   0.028828
0.002385   0.003362   0.004509   0.006510   0.010535   0.017273   0.029696
                                                 etc.
```

Software Controller: ABR Control & Indicators

1. Set Stimuli



2. Start START

3. Watch Data Acquisition →

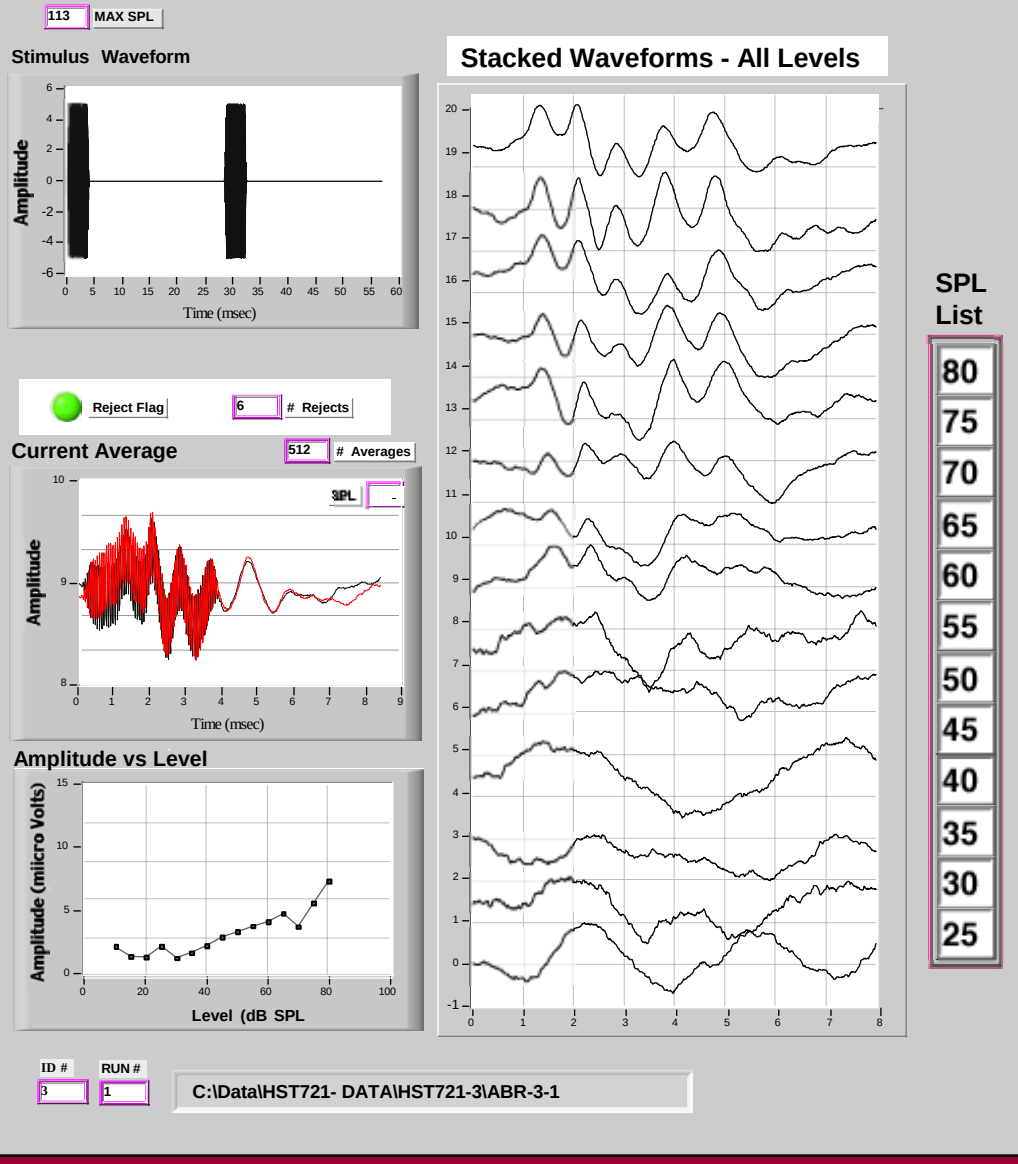
ABORT

4. Add Notes (Optional)

5. Save SAVE DATA

6. Note FilePath:

7. Return to Main RETURN



Software Controller: Data Storage

```
:RUN-0 ABR I-O 10/24/2003 4:47 PM: EAR: R FREQ: 16.00 # AVES: 400 REP RATE (/sec): 80    SAMPLING
(µsec): 10
:NOTES-
:CHAMBER-4
:SPLs TESTED-20;30;40;50;60;70;80;

:ANALYZED DATA
:SPL        "NEURAL" P-P          "CM" P-P
20.000       1.563        1.296
30.000       1.587        1.529
40.000       1.514        1.017
50.000       1.562        1.566
60.000       1.820        1.490
70.000       2.368        2.671
80.000       3.563        4.549

:RAW WAVEFORMS
 -0.084572    -0.060116    -0.104443     0.059216     0.167206    -0.009075    -0.132732
 -0.046043    -0.051418    -0.105358     0.054485     0.158127    -0.014187    -0.088329
-0.042152    -0.030743    -0.097805     0.046932     0.125854    -0.006329    -0.072536
```