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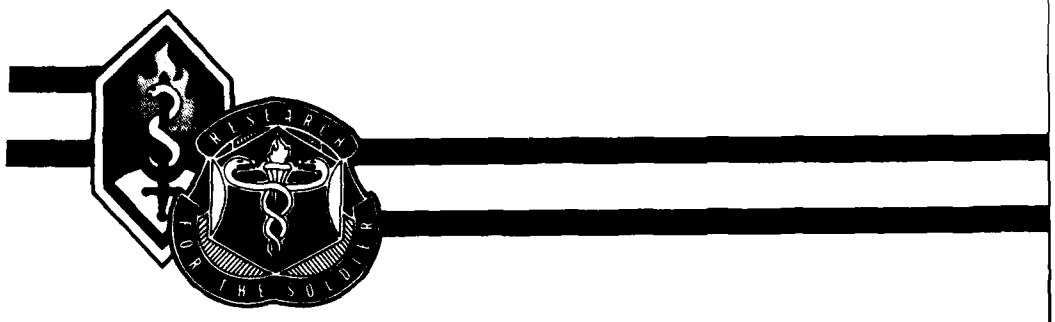

# The Hazard of Exposure to 2.075 kHz Center Frequency Narrow Band Impulses



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United States Army Aeromedical Research Laboratory
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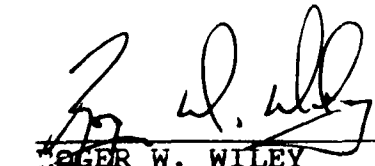

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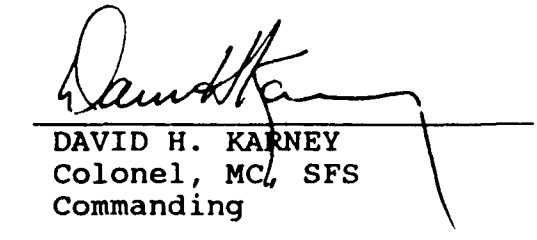

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19. ABSTRACT (Continue on reverse if necessary and identify by block number)

A previous report by Patterson et al., (1991) derived a frequency weighting function from audiometric and histological data gathered on 118 chinchillas exposed to a variety of narrow band impulses at various peak intensities. The weighting function clearly demonstrated that equivalent amounts of impulsive energy concentrated at different frequencies is not equally hazardous to the auditory system. However, on the basis of a preliminary analysis of a large amount of audiometric data obtained from chinchillas exposed to high level blast waves (Patterson and Hamernik, 1991), there appeared to be some inconsistencies between the narrow band impulse data and the blast wave data in the region of 2.0 kHz. To resolve this discrepancy, two additional groups of animals were exposed to narrow band impulses with a center frequency of 2.075 kHz and peak intensities of 134 dB and 139 dB. The results of these two additional groups confirm the shape of the original P-weighting function and indicate that changes must be made in our approach to the analysis of the blast wave data referred to above.

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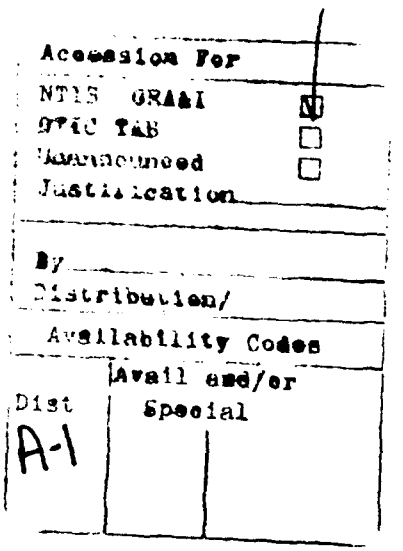

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## Introduction

One of the major problems associated with existing criteria for exposure to high levels of impulse noise is the total lack of specific attention that is paid to the energy spectrum of the impulse. Virtually all criteria focus on the trading relation between intensity and time or some measure of total energy. Since the auditory system processes an acoustic stimulus in a frequency specific manner, a criterion for exposure to transients should reflect the frequency specific characteristics of the auditory system and how those characteristics are related to susceptibility to impulse noise trauma. An earlier report by Patterson et al., (1991) showed that a frequency weighting function for transients could be derived. This weighting function was based upon audiometric and histological data gathered from 118 chinchillas exposed to a variety of narrow band (frequency specific) impulses at various peak intensities. The weighting function clearly demonstrates that equivalent amounts of impulsive energy concentrated at different frequencies are not equally hazardous to the auditory system. Since the weighting function was obtained using narrow band tone pips as the exposure stimulus, it was important to determine the extent to which this weighting function could be applied to actual high intensity blast wave stimuli. A large body of audiometric data (Patterson and Hamernik, 1991), obtained from chinchillas exposed to three spectrally different blast waves, was analyzed using an approach that related the 90th percentile group mean PTS averaged at 1, 2 and 4 kHz to the P-weighted sound exposure level (SEL) of the blast wave exposure. Details of this specific analysis can be found in Patterson and Hamernik, (1991). The results of the analysis indicated that the appropriate weighting function was similar to the P-weighting function at all frequencies for which data were available except in the vicinity of 2 kHz where there was an approximate 10 dB discrepancy as shown in Figure 1. To resolve this discrepancy, two additional groups of animals were exposed to narrow band impulses with a center frequency (CF) of 2.075 kHz, and peak intensity of 134 dB or 139 dB. This report presents the results obtained from these two additional groups.

## Methods and procedures

The methods and experimental paradigm were identical to those presented in Patterson et al., (1991) and thus will not be repeated in detail here. Basically, an avoidance conditioning paradigm was used to obtain pre- and postexposure threshold measurement at 10 audiometric test frequencies between 0.125 and 8 kHz. Thresholds were followed after exposure at regular intervals over a period of 30 days, at

which time the animals were sacrificed for surface preparation histology. Each animal was individually exposed at a normal angle of incidence to one of the two exposure conditions shown in Table 1. The exposures consisted of the presentation of 100 narrow band impulses at the rate of 1 per 3 seconds. Each experimental group consisted of six animals. The impulses were computer generated and transduced to an acoustic stimulus as in Patterson et al. (1991). The pressure-time history and energy spectra of the narrow band stimulus used are shown in Figure 2. From the pressure-time history of the impulsive stimulus, the integral of pressure squared over time was computed to obtain the total sound exposure level (SEL) re: 20m Pa sec for each exposure condition (Table 1).

## Results and discussion

The mean preexposure audiogram for the 12 animals used in these experiments along with the normative data of Miller (1970) is shown in Figure 3. The group mean thresholds for the two groups are shown in Table 2. A two-way analysis of variance showed that there was no statistically significant difference in the thresholds between the two groups. For each animal threshold shifts (TS) were computed by subtracting that animal's preexposure threshold from the postexposure threshold at each audiometric test frequency. The audiometric effects of each exposure were documented in three ways:

(1) The mean threshold shift recovery functions for each group and each test frequency (Figures 4 through 13).

(2) The maximum TS for each group and for each test frequency (Figure 14).

(3) The permanent threshold shift (PTS) for each group and for each test frequency (Figure 15).

Bars represent the standard error of the mean. If no bar is present, the standard error was less than the size of the symbol.

All three of the above sets of audiometric data were consistent in showing that the higher intensity stimulus produced the more severe threshold shifts. All individual animal thresholds and group mean thresholds are summarized in the appendix.

The group mean inner and outer hair cell losses are shown in Figure 16. As seen in the audiometric data, the more intense stimulus caused a greater loss; however, unlike the audiometric data, there is a clear frequency effect in the

Table 1

Definition of experimental groups.

| Group | N | Center frequency (Hz) | Peak SPL (dB) | Total SEL (dB) |
|---|---|---|---|---|
| 1 | 6 | 2075 | 134 | 124.5 |
| 2 | 6 | 2075 | 139 | 129.3 |
| Total | 12 | | | |

Table 2

Preexposure threshold means (dB) and standard deviations for all groups compared to published forms.

| | | Test frequency (Hz) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Group | N | 125 | 250 | 500 | 1000 | 1400 | 2000 | 2800 | 4000 | 5700 | 8000 | |
| 1 | 6 | 16.5 | 9.7 | 2.8 | -1.2 | -1.2 | -2.2 | 0.3 | -0.5 | 4.7 | 3.2 | $\bar{X}$ |
| | | 3.7 | 1.6 | 3.2 | 2.0 | 3.0 | 2.3 | 3.3 | 3.0 | 2.8 | 4.2 | s |
| 2 | 6 | 17.2 | 8.0 | 1.7 | 1.8 | 0.7 | -0.2 | 0.8 | 1.0 | 0.8 | 1.5 | $\bar{X}$ |
| | | 5.7 | 5.1 | 3.5 | 3.8 | 3.3 | 2.7 | 3.6 | 5.3 | 3.4 | 1.8 | s |
| Total | 12 | 16.8 | 8.8 | 2.3 | 0.3 | -0.3 | -1.2 | 0.6 | 0.3 | 2.8 | 2.3 | $\bar{X}$ |
| | | 4.6 | 3.7 | 3.3 | 3.3 | 3.1 | 2.6 | 3.3 | 4.2 | 3.6 | 3.2 | s |
| Miller | | 19.9 | 8.8 | 5.1 | 3.0 | 2.2 | 2.7 | -0.2 | 1.9 | 1.9 | 5.8 | $\bar{X}$ |
| (1970) | | 5.4 | 3.9 | 6.1 | 4.1 | 6.6 | 4.7 | 4.9 | 7.1 | 6.7 | 5.4 | s |
| | | 36 | 36 | 36 | 36 | 34 | 36 | 35 | 36 | 35 | 36 | N |

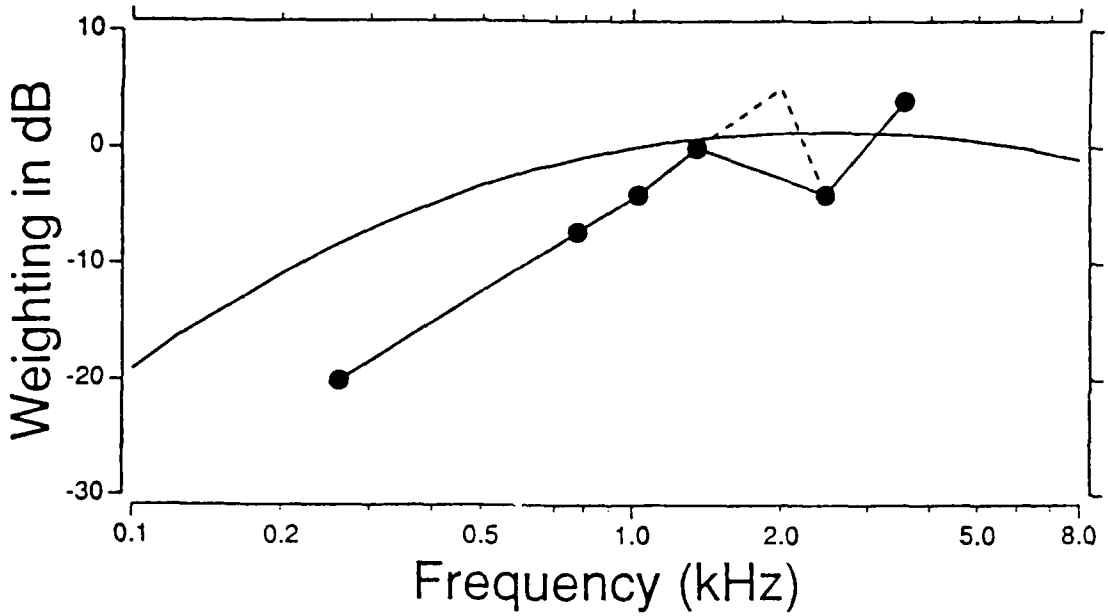


*Figure 1. The empirical P-weighting function from Patterson et al. (1991) (filled symbols) along with the conventional A-weighting function (solid line) and the weighting function inferred from the blast wave data of Patterson and Hamernik (1991) (dotted line).*

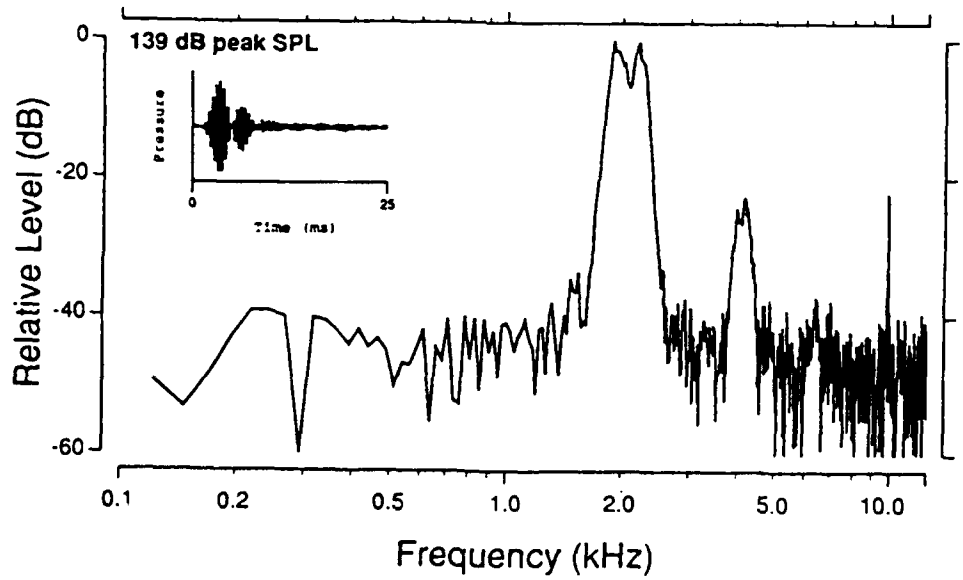


*Figure 2. The narrow band impulse pressure-time waveform (inset) and the relative frequency spectrum of the impulse for the 2.075 kHz CF, 139 dB peak SPL stimulus.*

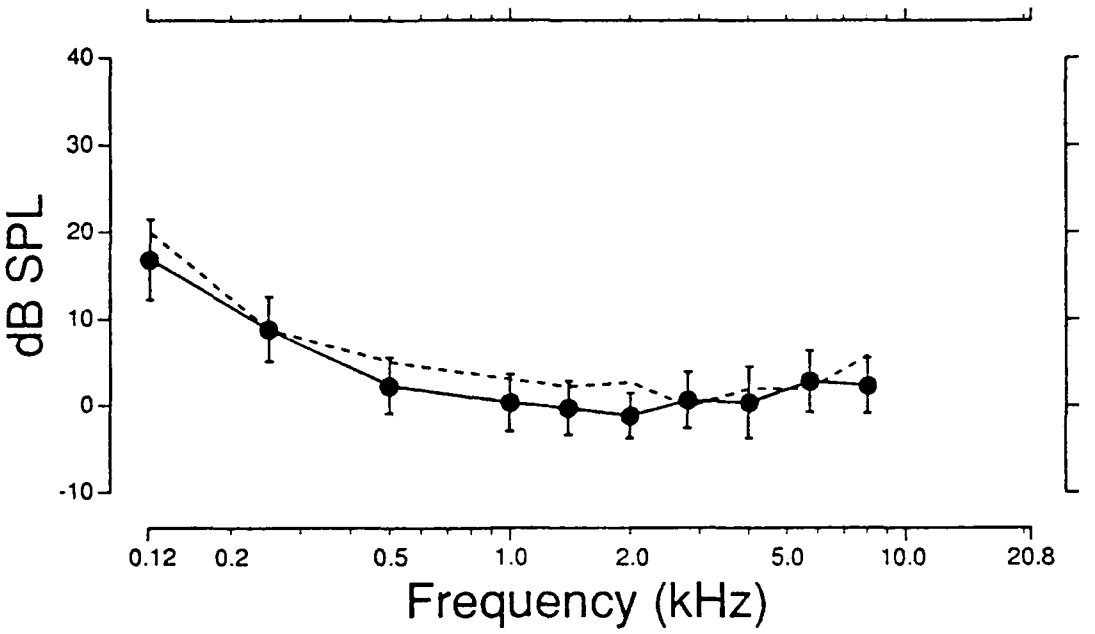


*Figure 3. The mean preexposure audiogram for all 12 chinchillas (symbols) compared to that of Miller (1970) (dashed line). The error bars represent one standard deviation above and below the plotted point.*

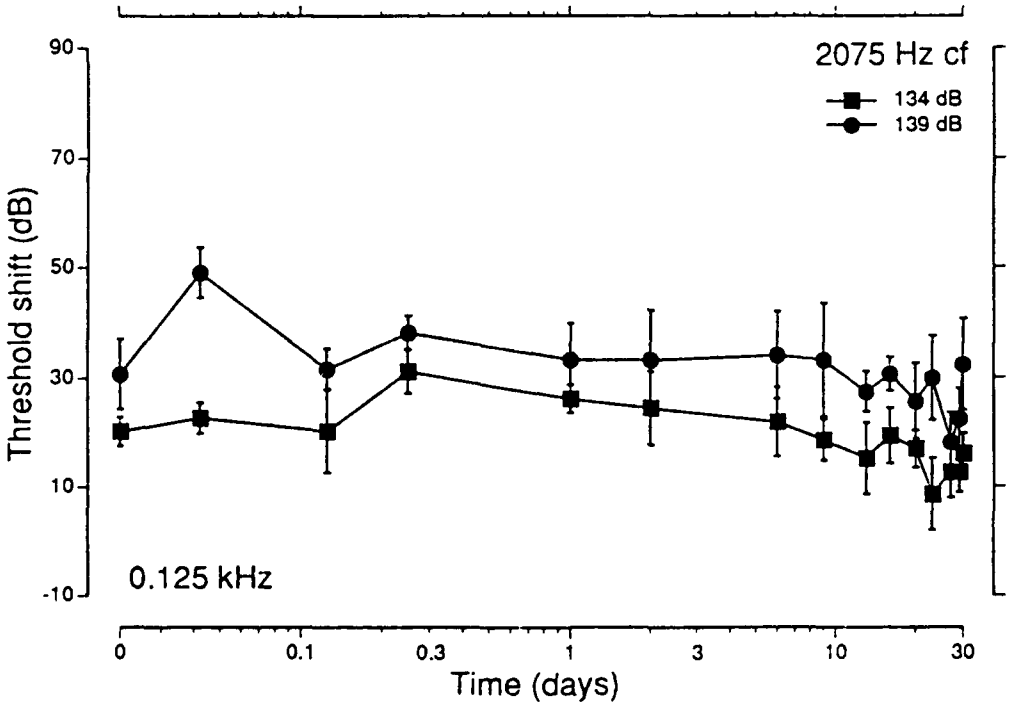


*Figure 4. The mean threshold recovery curves for the groups exposed to the 2.075 kHz CF impulse at the indicated peak SPL for the 0.125 kHz audiometric test frequency.*

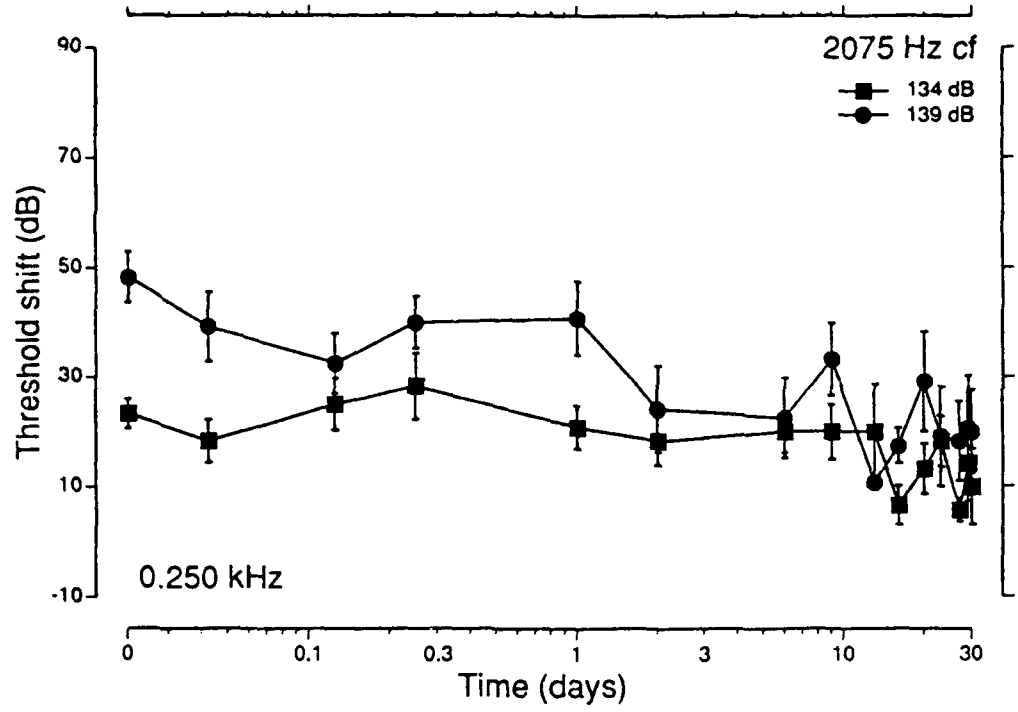


*Figure 5. The mean threshold recovery curves for the groups exposed to the 2.075 kHz CF impulse at the indicated peak SPL for the 0.250 kHz audiometric test frequency.*

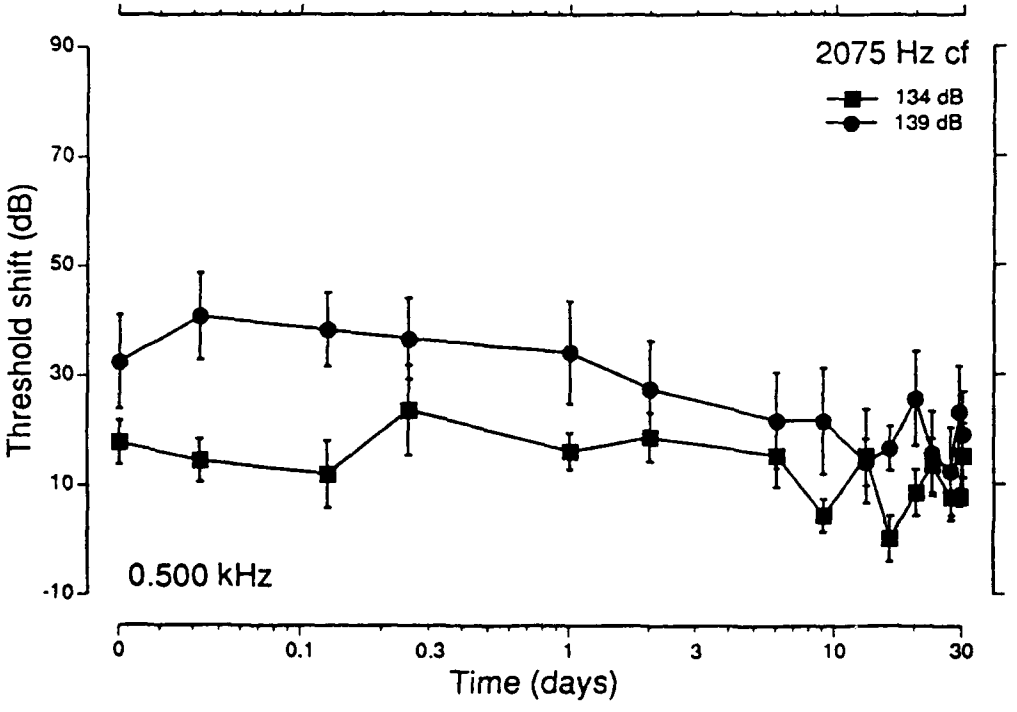


*Figure 6. The mean threshold recovery curves for the groups exposed to the 2.075 kHz CF impulse at the indicated peak SPL for the 0.500 kHz audiometric test frequency.*

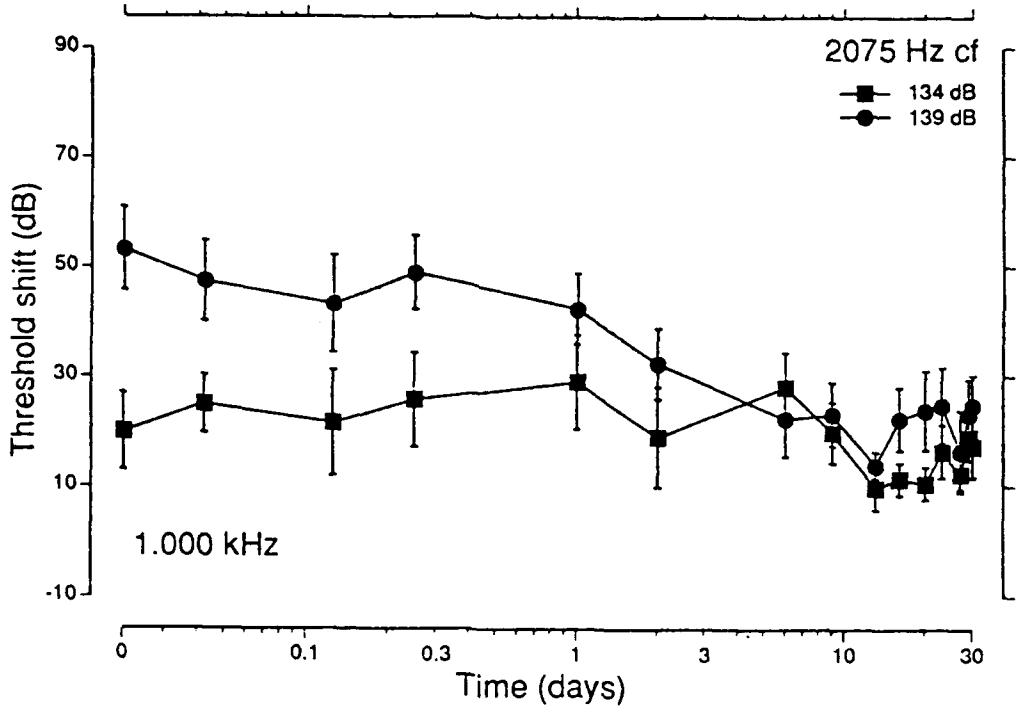


*Figure 7. The mean threshold recovery curves for the groups exposed to the 2.075 kHz CF impulse at the indicated peak SPL for the 1.000 kHz audiometric test frequency.*

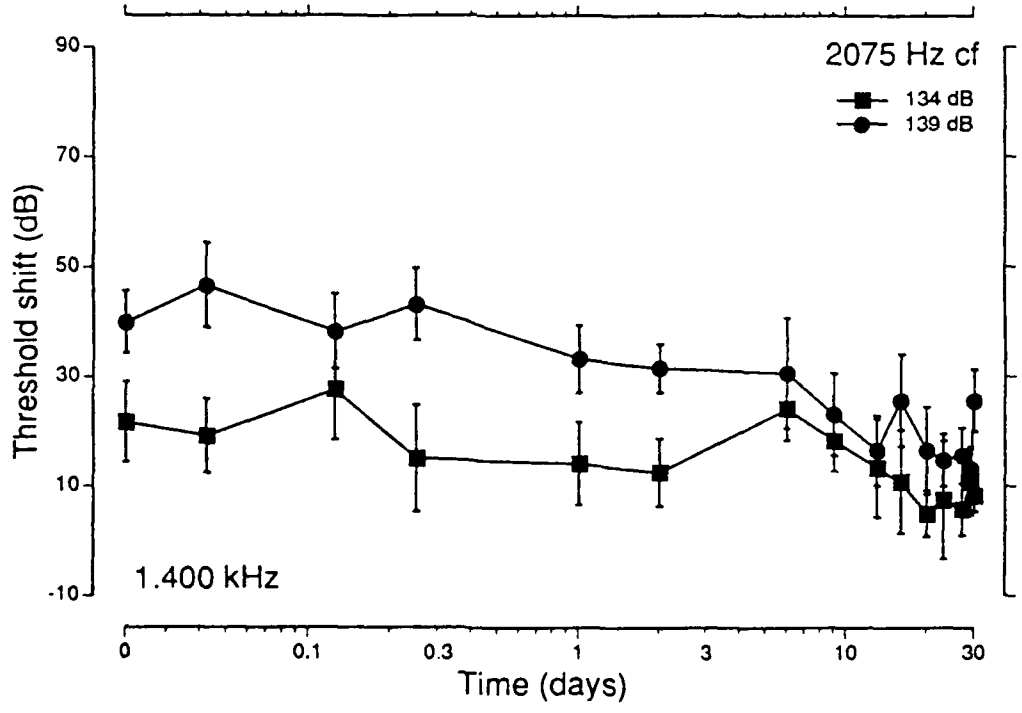


*Figure 8. The mean threshold recovery curves for the groups exposed to the 2.075 kHz CF impulse at the indicated peak SPL for the 1.400 kHz audiometric test frequency.*

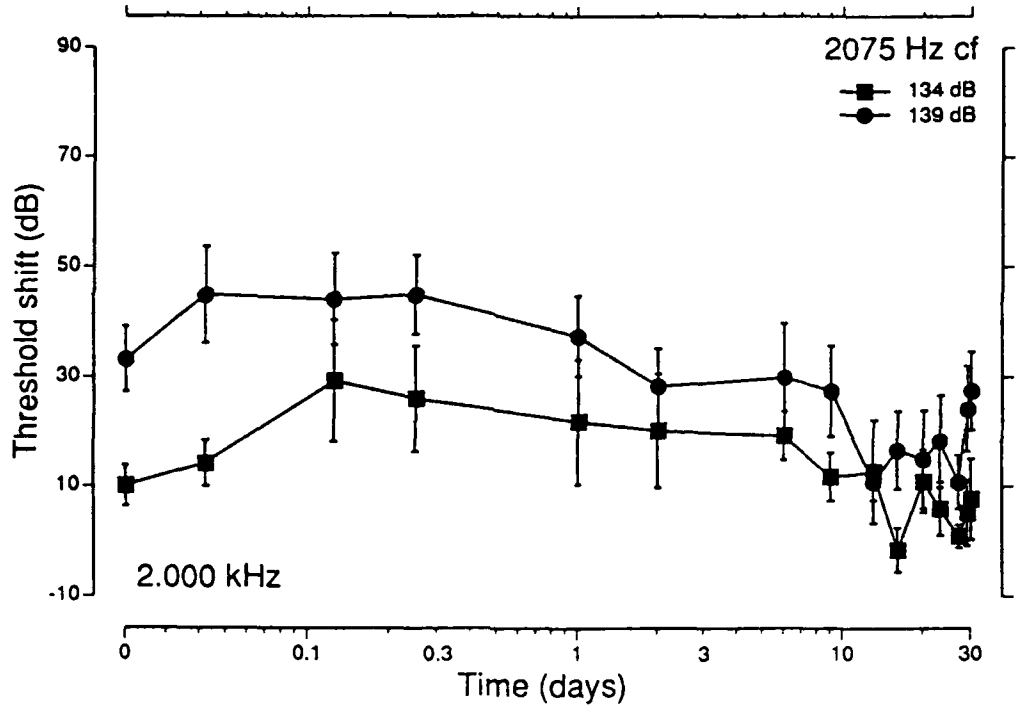


*Figure 9. The mean threshold recovery curves for the groups exposed to the 2.075 kHz CF impulse at the indicated peak SPL for the 2.000 kHz audiometric test frequency.*

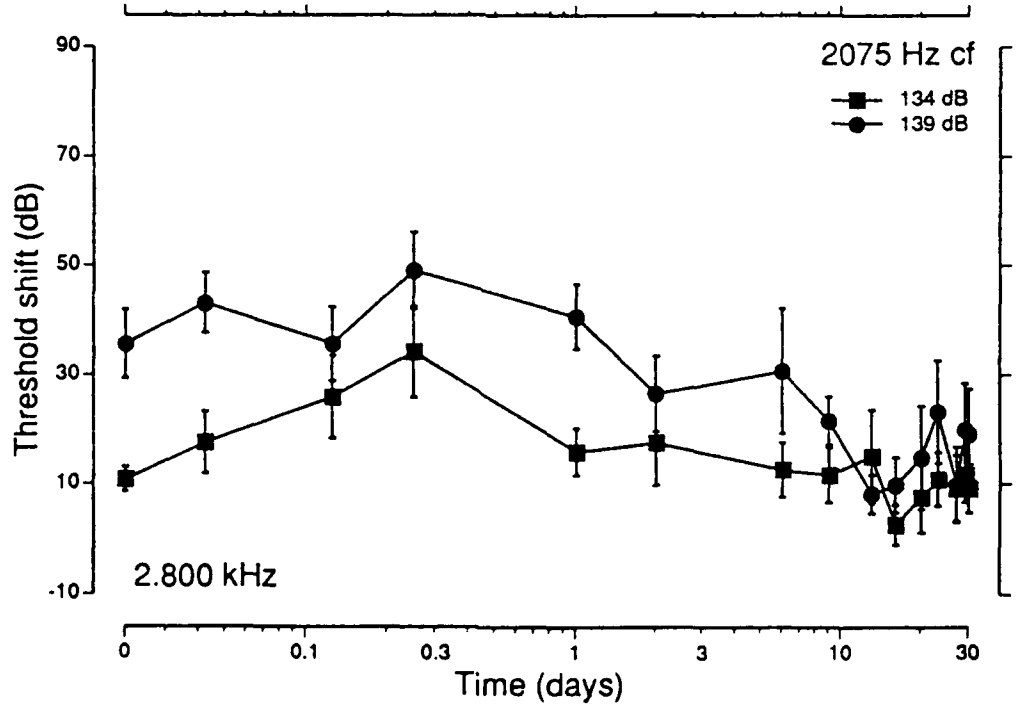


*Figure 10. The mean threshold recovery curves for the groups exposed to the 2.075 kHz CF impulse at the indicated peak SPL for the 2.800 kHz audiometric test frequency.*

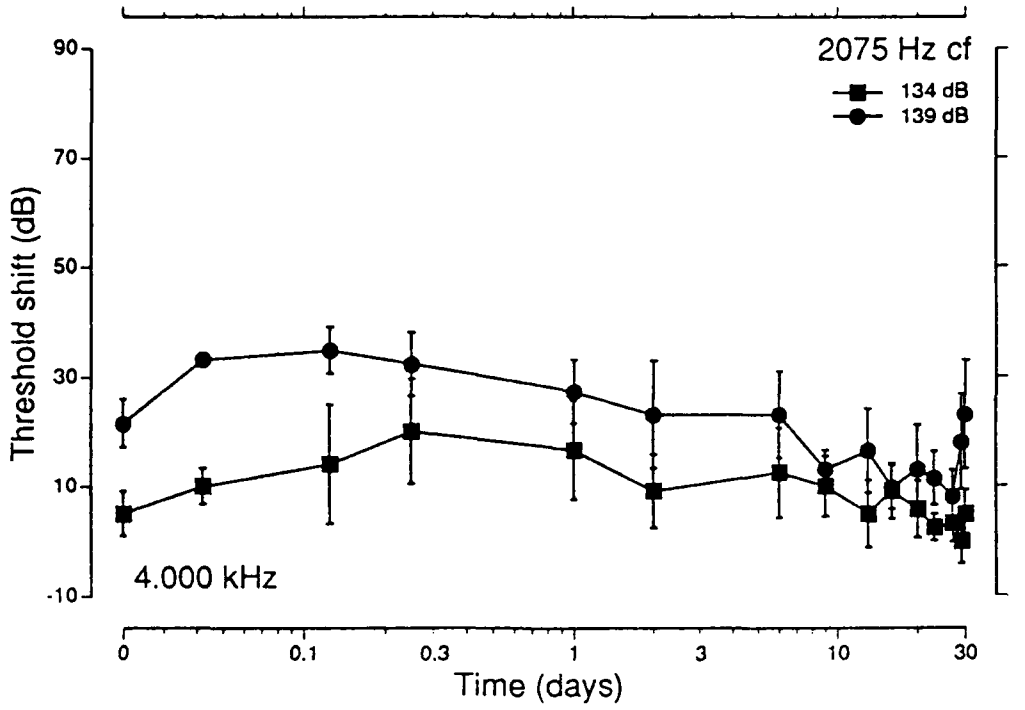


*Figure 11. The mean threshold recovery curves for the groups exposed to the 2.075 kHz CF impulse at the indicated peak SPL for the 4.000 kHz audiometric test frequency.*

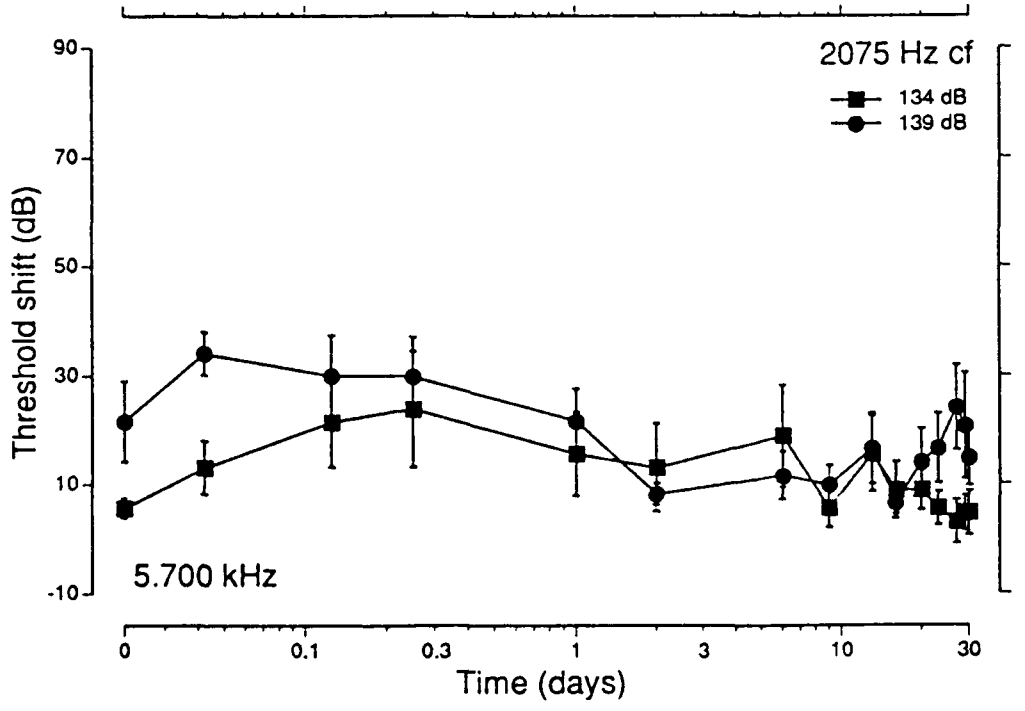


*Figure 12. The mean threshold recovery curves for the groups exposed to the 2.075 kHz CF impulse at the indicated peak SPL for the 5.700 kHz audiometric test frequency.*

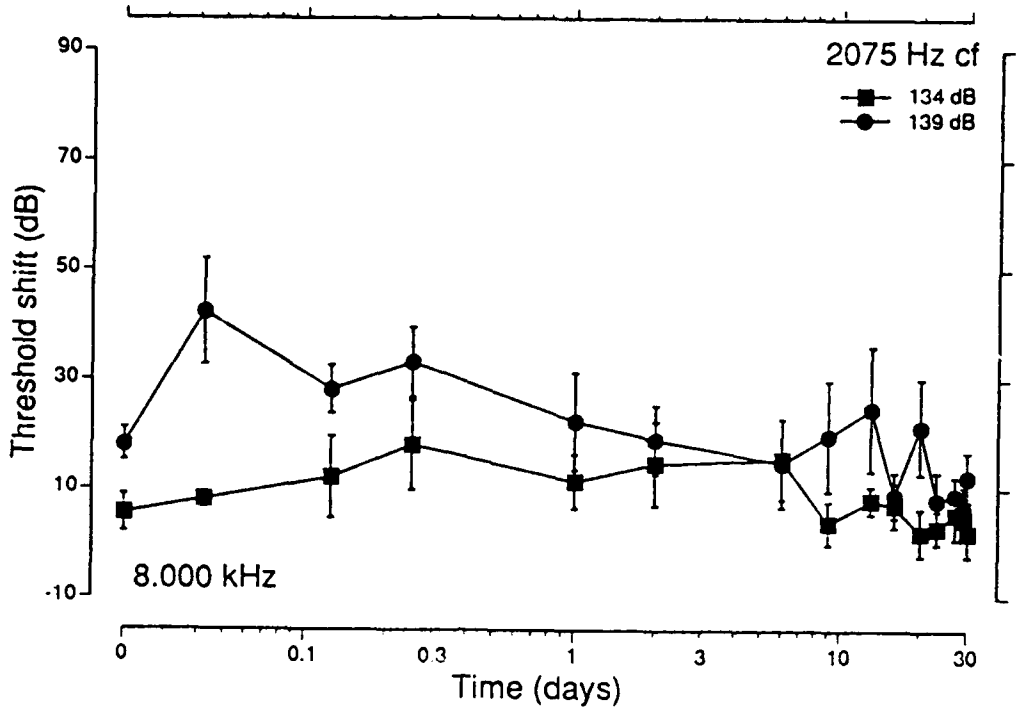


*Figure 13. The mean threshold recovery curves for the groups exposed to the 2.075 kHz CF impulse at the indicated peak SPL for the 8.000 kHz audiometric test frequency.*

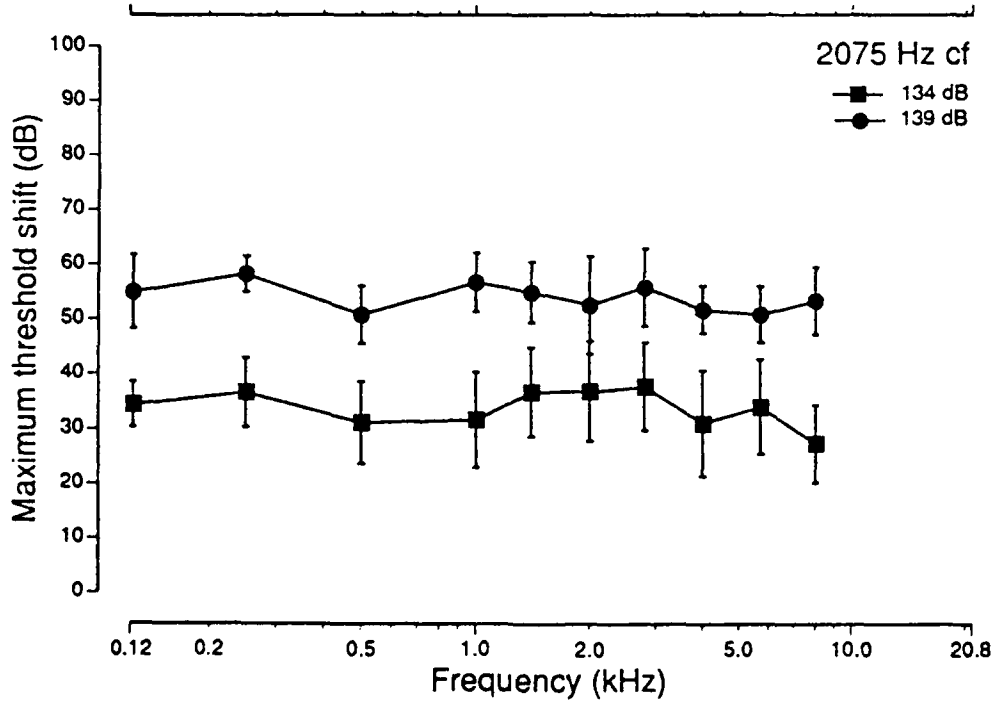


*Figure 14. The group mean maximum threshold shift for each audiometric test frequency following exposure to the 2.075 kHz CF impulse at the indicated peak SPL.*

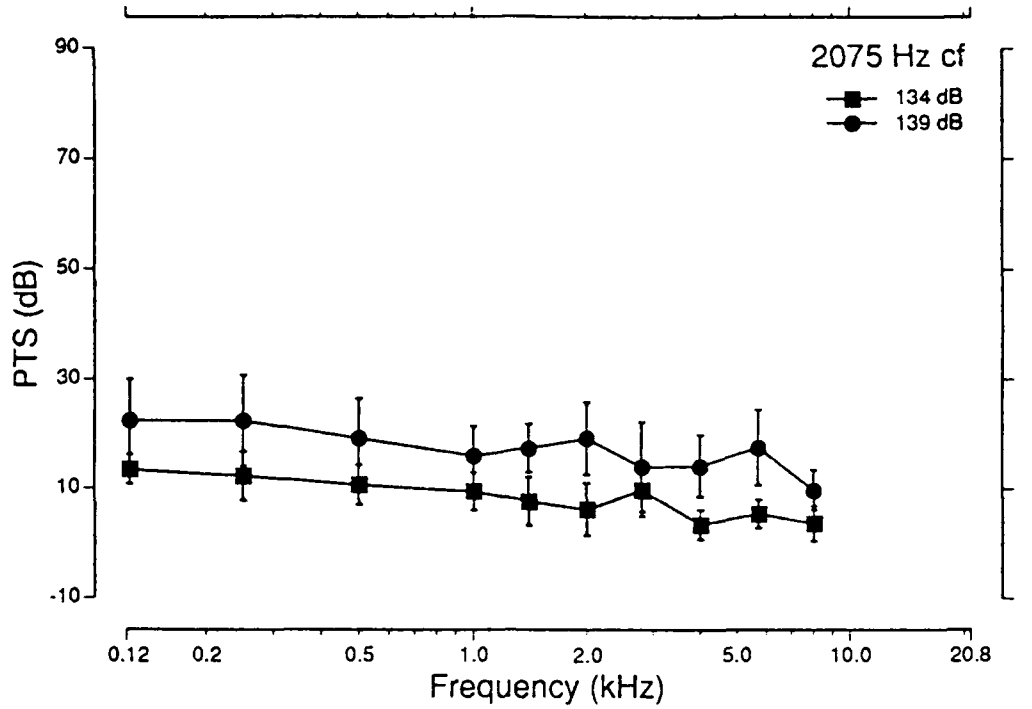


*Figure 15. The group mean permanent threshold shift for each audiometric test frequency following exposure to the 2.075 kHz CF impulse at the indicated peak SPL.*

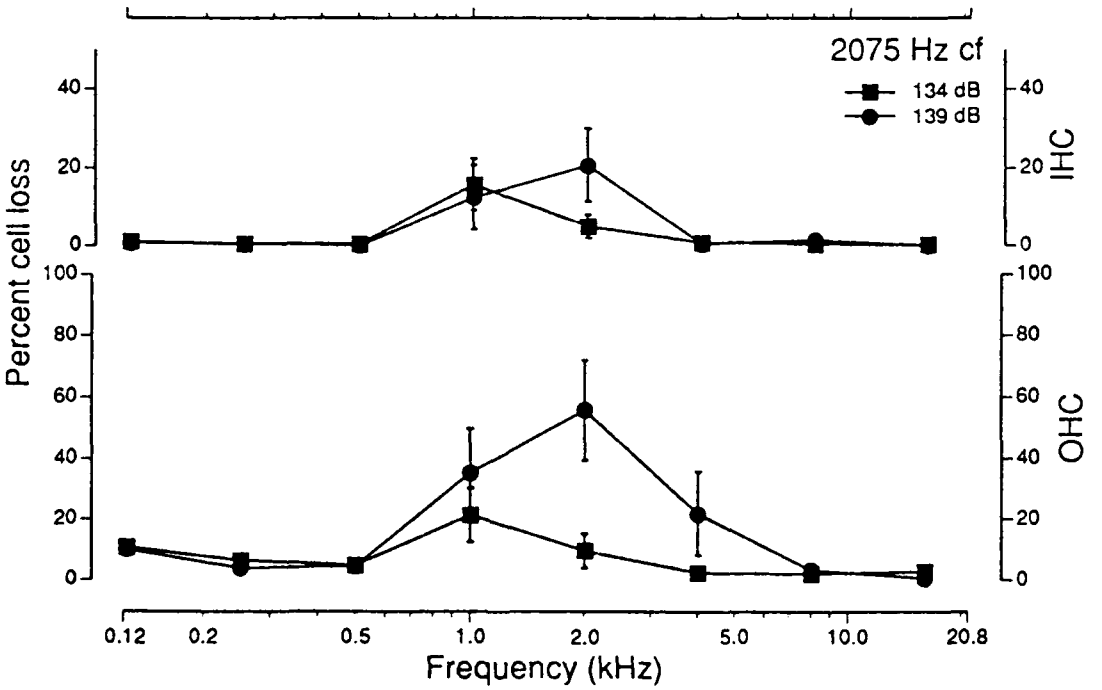


*Figure 16. The group mean outer hair cell (OHC) loss and inner hair cell (IHC) loss within octave band lengths of the basilar membrane at the indicated frequencies following exposure to the 2.075 kHz CF impulse at the indicated peak SPL.*

sensory cell loss data. The 139-dB peak SPL impulse produced a well defined lesion in the 2 kHz region of the cochlea, while the lesion produced by the 134 dB impulse was located near the 1-kHz region. For each animal, cochleograms which quantify the sensory population of the noise damaged cochlea are also shown in the appendix along with group mean sensory cell loss data.

Following the analysis procedures used in Patterson et al., (1991), these data were incorporated into the P-weighting function. Figure 17 shows the group mean PTS measured at 1, 2 and 4 kHz ($PTS^{1,2,4}$) for the two groups of animals exposed to the 2.075 kHz impulse plotted as a function of total SEL along with the data from Patterson et al., (1991), which were used to derive the P-weighting function. The results of this data reduction for the 2.075 kHz impulse are very similar to those of the 1.025 kHz impulse. The effect of shifting these data along the SEL axis, the amount necessary to collapse the data into a single PTS versus SEL function using the 1.350-kHz series of data as the reference point is shown in Figure 18. The amounts shifted were: 0.260 kHz CF impulses, -20 dB; 0.775 kHz CF impulses, -7.2 dB; 1.025 kHz CF impulses, -4 dB; 1.350 kHz CF impulses, 0 dB; 2.075 kHz CF imulses, -4 dB; 2.450 kHz CF impulses, -4 dB and 3.550 kHz impulses, +4 dB. The relative frequency weighting function derived from the shift of the data shown in Figure 17 is shown in Figure 19.

Figure 20 shows the total group mean sensory cell loss data for the 2.075 kHz impulse as a function of the total SEL along with the Patterson et al., (1991), data. Applying P-weighting function shown in Figure 19 to the sensory cell data produces the realignment of these data seen in Figure 21 thus reinforcing the validity of the weighting function. A regression line through these sensory cell data yields a correlation coefficient of 0.849 and 0.841 for the outer hair cell and inner hair cell losses respectively.

## Conclusions

Both the audiometric and the histological results indicate that the general shape of the P-weighting function proposed in the Patterson et al., (1991), document, in the vicinity of 2 kHz, is appropriate for narrow band impulse exposures. Thus, the inconsistency seen in the 2-kHz region when P-weighting is applied to blast wave transients cannot be explained on the basis of the proposed shape of the P-weighting function. The apparent differences between the narrow based impulses and the blast wave data still need to be resolved.

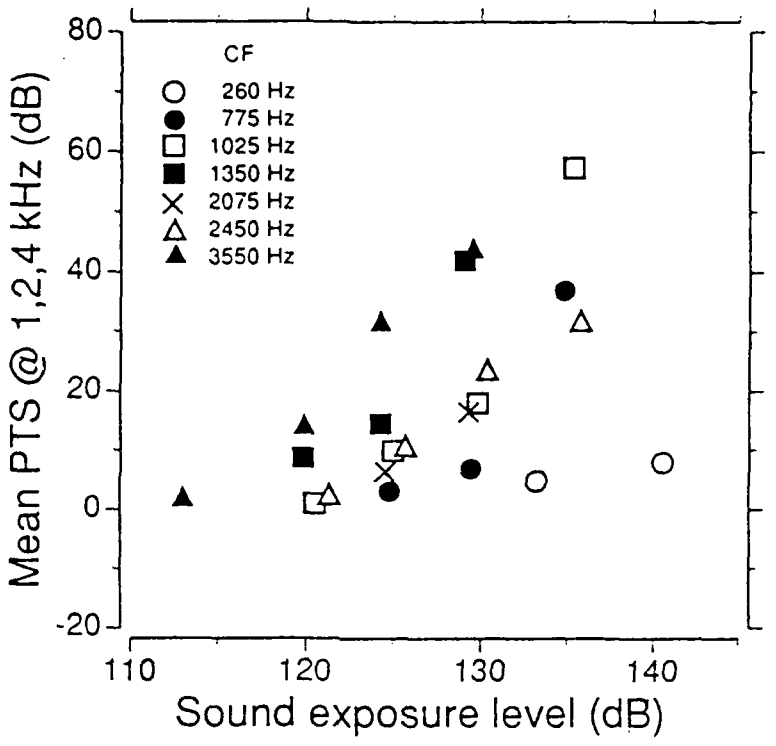


*Figure 17. The group mean PTS evaluated at 1, 2 and 4 kHZ ($\overline{PTS}_{1,2,4}$) as a function of the total sound-exposure level for 22 groups of animals exposed to various narrow band impulses.*

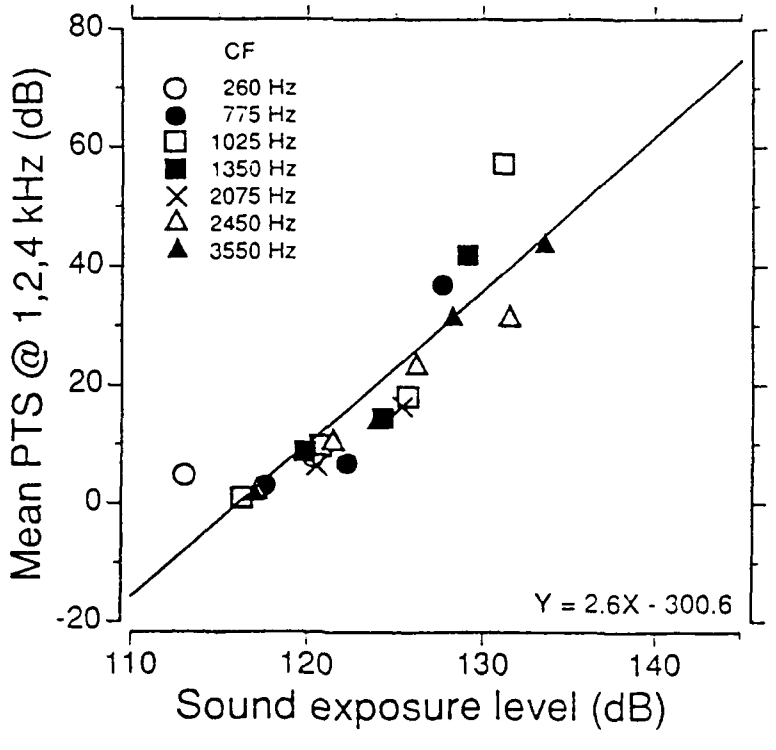


*Figure 18. The $\overline{PTS}_{1,2,4}$ as a function of the P-weighted total sound exposure level. The regression line yields a correlation coefficient of 0.898.*

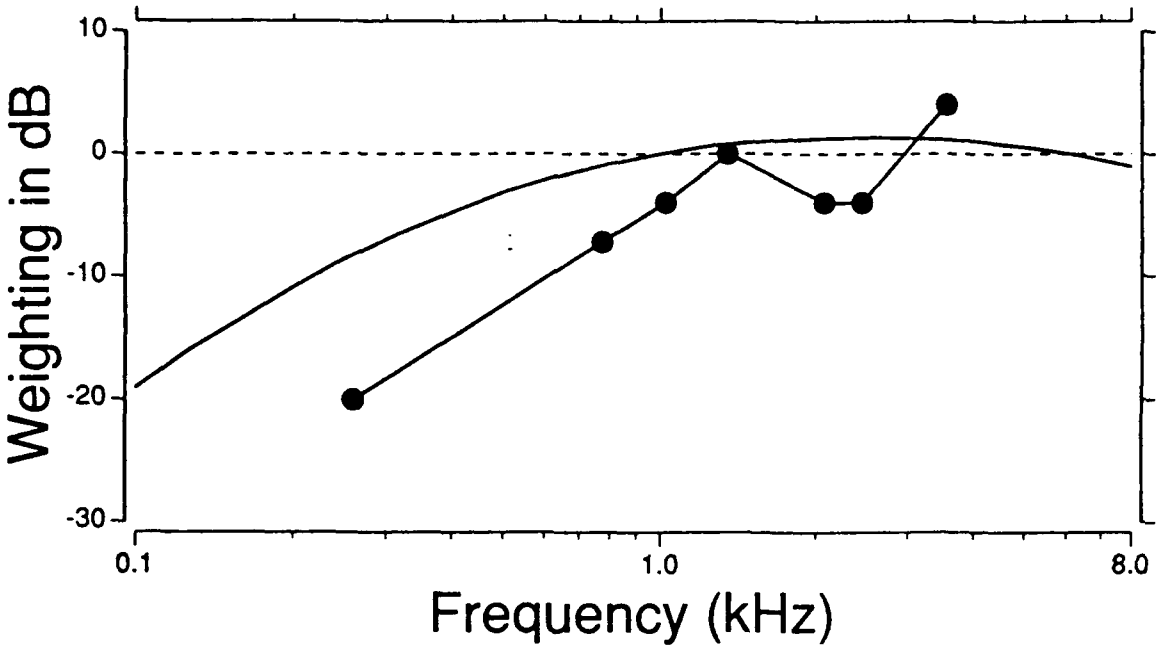


*Figure 19. The empirical P-weighting function (symbols) derived from the narrow band exposure data along with the conventional A-weighting function (solid line).*

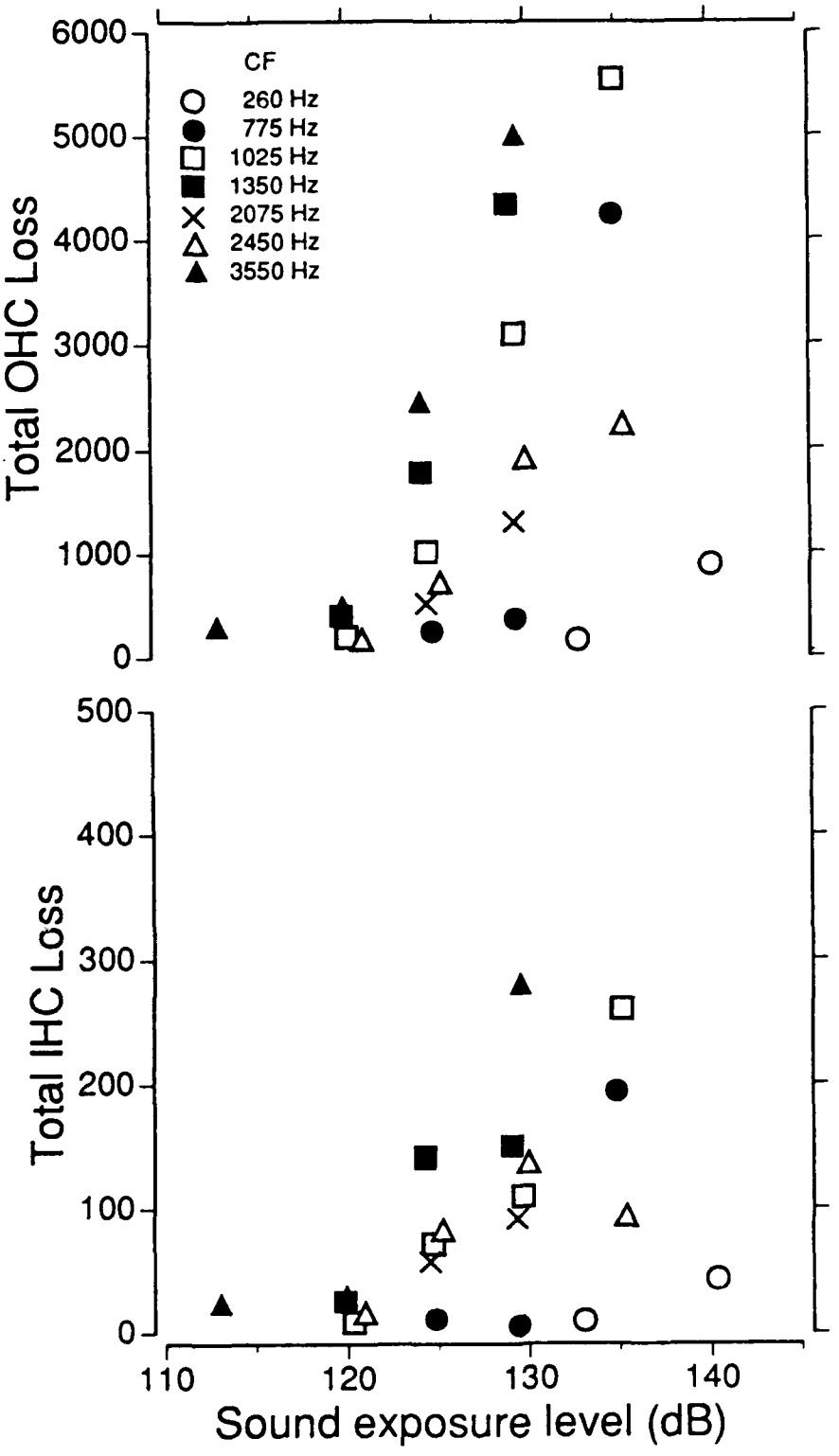


*Figure 20. The group mean total outer (upper) and inner (lower) hair cell loss as a function of the total sound exposure level for 22 groups of animals exposed to various narrow band impulses.*

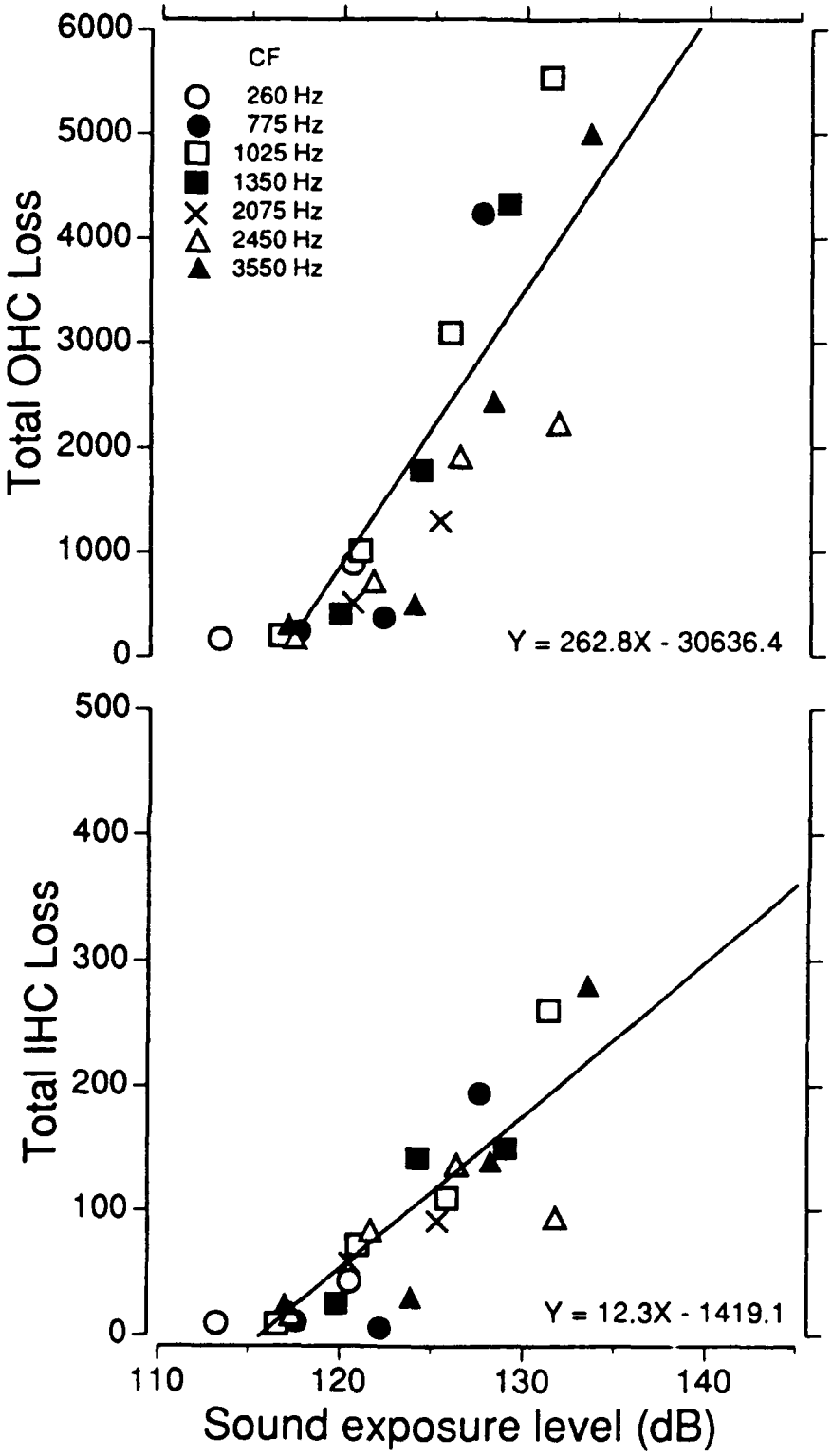


*Figure 21. The group mean total outer (upper) and inner (lower) hair cell loss as a function of the P-weighted total sound level. The regression lines yield correlation coefficients of 0.849 and 0.841 for outer and inner hair cell loss respectively.*

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## List of manufacturers

Altec Lansing Corporation
1515 South Manchester Avenue
Anaheim, CA 92803

# Appendix

Individual data and Group summary statistics.

## Guide to the appendix

The individual data and summary statistics for each experimental group are presented in the data appendix that follows. The following paragraphs present a brief description of the contents of the data appendix. In this summary, only a single exposure group of the appendix is described. All the remaining exposure groups are organized in the same manner.

### Group title page

The group title page indicates the exposure that each animal in this group received (e.g., 2075 Hz center frequency, 134-dB peak SPL) and the subjects that comprise this group.

### Preexposure and permanent threshold shift audiograms

The top panel depicts the mean preexposure thresholds for this group. The error bars on this figure and all others in the appendices represent one standard error of the mean plotted above and below the mean. The lower panel presents the group mean PTS measured between 20 and 30 days after exposure.

### Preexposure, postexposure, and PTS measurements

This page tabulates the pre- and postexposure thresholds (in dB SPL) for each subject as well as the group mean and standard deviation. PTS is computed by subtracting the pre-exposure threshold from the postexposure threshold for each subject.

### Temporary threshold shift

This table presents the threshold shift for each of the 10 audiometric frequencies measured immediately after exposure and at regular intervals up to 30 days postexposure.

### Total cell loss summary

The total sensory cell losses for this group are presented in the top portion of this table. The lower portion of the table presents the mean and standard deviation for the total number of inner and outer hair cells missing along octave band lengths of the cochlea.

## Total cell losses

The total sensory cell losses in octave band lengths of the cochlea for each animal that comprises the exposure group are presented in this table. Also included at the end of the table are the group mean and standard deviation for each octave band length.

## Present sensory cell losses

This table presents the percent sensory cell losses in octave band lengths of the cochlea for each animal in this group. Also, included are the means and standard deviation for each sensory cell and octave band length.

## Cochleograms and PTS audiograms

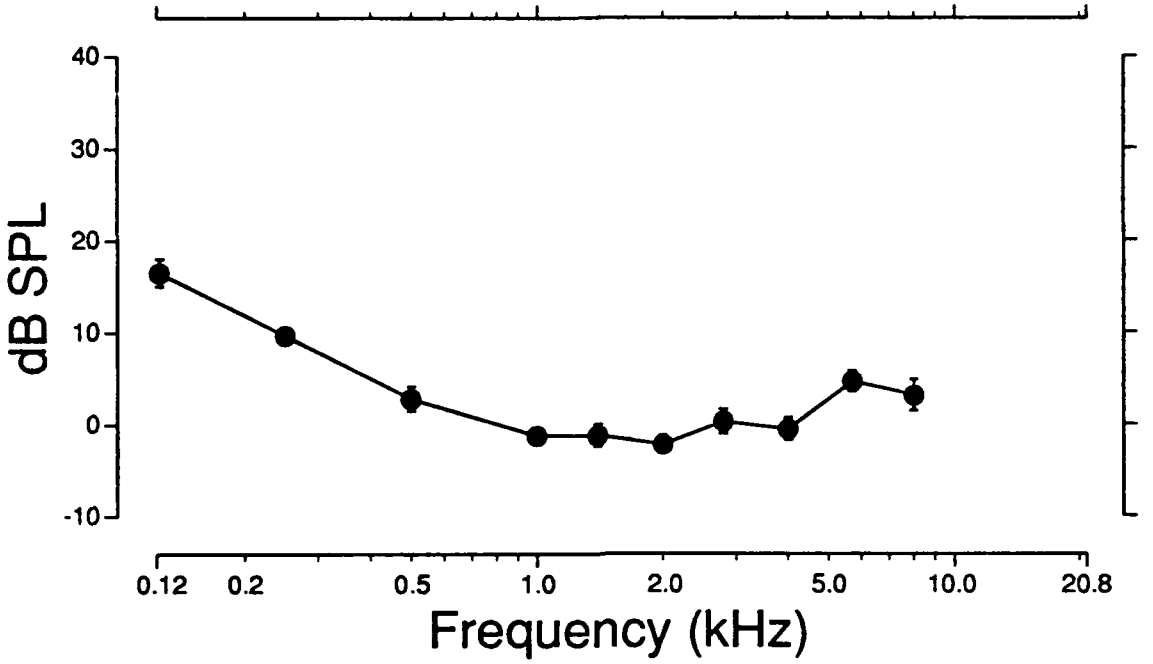
These figures present cochleograms and PTS audiograms for each animal in the exposure group. The cochleograms show the percent inner and outer hair cell losses for each 0.24 mm segment of the basilar membrane. The PTS audiogram is plotted to allow easy comparison of the PTS and cell loss resulting from the noise exposure.

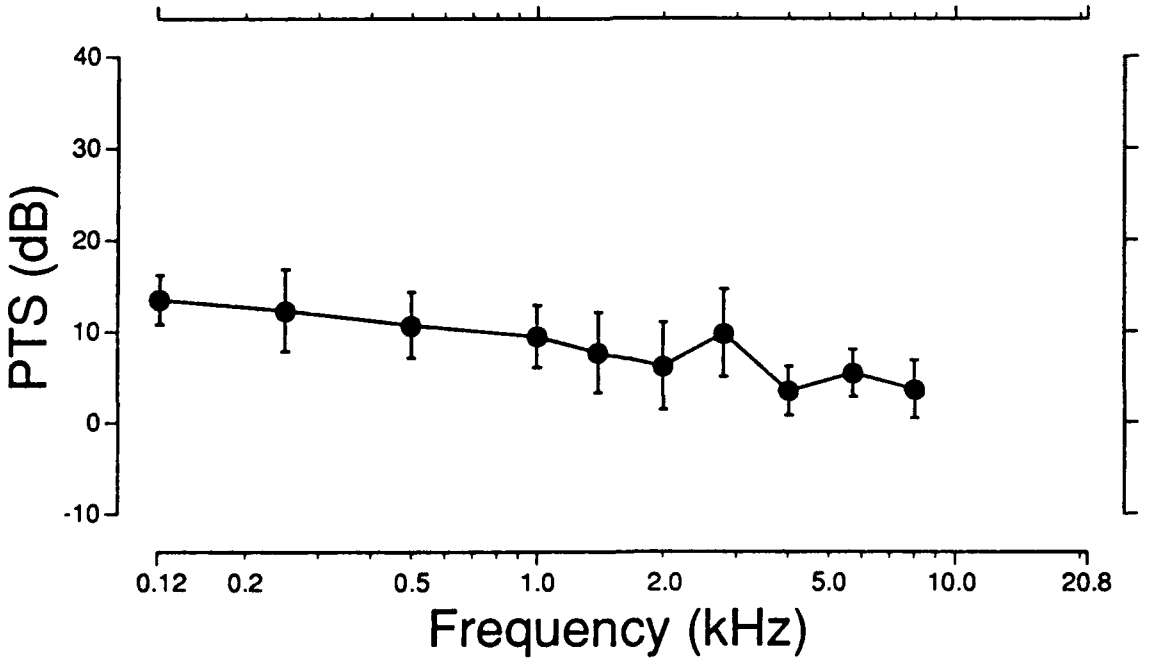
Summary data for the group exposed to

2075 Hz center frequency, 134-dB peak SPL

Animal #

| | | |
|---|---|---|
| S70 | - | Completed the entire protocol |
| T71 | - | Completed the entire protocol |
| U86 | - | Completed the entire protocol |
| U87 | - | Completed the entire protocol |
| U91 | - | Completed the entire protocol |
| U100 | - | Completed the entire protocol |


2075 Hz center frequency, 134 dB peak SPL
dB SPL
40
30
20
10
0
-10
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
Frequency (kHz)


PTS (dB)
40
30
20
10
0
-10
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
Frequency (kHz)

2075 Hz center frequency, 134 dB Peak SPL

Preexposure thresholds (dB SPL)

| Animal\kHz | .125 | 0.25 | 0.5 | 1.0 | 1.4 | 2.0 | 2.8 | 4.0 | 5.7 | 8.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| S70 | 17.5 | 10.5 | 3.5 | 1.5 | 2.5 | -3.5 | -4.5 | -5.5 | 5.5 | -1.5 |
| T71 | 14.5 | 6.5 | -1.5 | -2.5 | -1.5 | -5.5 | 1.5 | -0.5 | 4.5 | 3.5 |
| U86 | 16.5 | 9.5 | 3.5 | 0.5 | -1.5 | -0.5 | 0.5 | -1.5 | 4.5 | 1.5 |
| U87 | 10.5 | 10.5 | 5.5 | -3.5 | -6.5 | -3.5 | 3.5 | 0.5 | 7.5 | -0.5 |
| U91 | 18.5 | 10.5 | 6.5 | -2.5 | -0.5 | 0.5 | -2.5 | 3.5 | -0.5 | 6.5 |
| U100 | 21.5 | 10.5 | -0.5 | -0.5 | 0.5 | -0.5 | 3.5 | 0.5 | 6.5 | 9.5 |
| Mean | 16.5 | 9.7 | 2.8 | -1.2 | -1.2 | -2.2 | 0.3 | -0.5 | 4.7 | 3.2 |
| S.D. | 3.7 | 1.6 | 3.2 | 2.0 | 3.0 | 2.3 | 3.3 | 3.0 | 2.8 | 4.2 |

Postexposure thresholds (dB SPL)

| Animal\kHz | .125 | 0.25 | 0.5 | 1.0 | 1.4 | 2.0 | 2.8 | 4.0 | 5.7 | 8.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| S70 | 38.0 | 25.0 | 11.0 | 12.0 | 7.0 | -6.0 | -4.0 | -10.0 | 13.0 | 7.0 |
| T71 | 34.0 | 14.0 | 4.0 | -1.0 | 1.0 | -3.0 | 8.0 | 2.0 | 6.0 | 6.0 |
| U86 | 26.5 | 23.5 | 16.5 | 7.5 | 13.5 | 13.5 | 12.5 | 7.5 | 7.5 | 10.5 |
| U87 | 28.0 | 41.0 | 32.0 | 22.0 | 18.0 | 23.0 | 35.0 | 14.0 | 24.0 | 9.0 |
| U91 | 28.0 | 21.0 | 7.0 | 3.0 | 6.0 | 1.0 | 7.0 | 5.0 | 6.0 | 10.0 |
| U100 | 25.5 | 7.5 | 10.5 | 6.5 | -6.5 | -4.5 | 2.5 | -0.5 | 4.5 | -1.5 |
| Mean | 30.0 | 22.0 | 13.5 | 8.3 | 6.5 | 4.0 | 10.2 | 3.0 | 10.2 | 6.8 |
| S.D. | 4.9 | 11.4 | 10.0 | 8.0 | 8.7 | 11.7 | 13.4 | 8.1 | 7.4 | 4.4 |

Permanent threshold shift (dB)

| Animal\kHz | .125 | 0.25 | 0.5 | 1.0 | 1.4 | 2.0 | 2.8 | 4.0 | 5.7 | 8.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| S70 | 20.5 | 14.5 | 7.5 | 10.5 | 4.5 | -2.5 | 0.5 | -4.5 | 7.5 | 8.5 |
| T71 | 19.5 | 7.5 | 5.5 | 1.5 | 2.5 | 2.5 | 6.5 | 2.5 | 1.5 | 2.5 |
| U86 | 10.0 | 14.0 | 13.0 | 7.0 | 15.0 | 14.0 | 12.0 | 9.0 | 3.0 | 9.0 |
| U87 | 17.5 | 30.5 | 26.5 | 25.5 | 24.5 | 26.5 | 31.5 | 13.5 | 16.5 | 9.5 |
| U91 | 9.5 | 10.5 | 0.5 | 5.5 | 6.5 | 0.5 | 9.5 | 1.5 | 6.5 | 3.5 |
| U100 | 4.0 | -3.0 | 11.0 | 7.0 | -7.0 | -4.0 | -1.0 | -1.0 | -2.0 | -11.0 |
| Mean | 13.5 | 12.3 | 10.7 | 9.5 | 7.7 | 6.2 | 9.8 | 3.5 | 5.5 | 3.7 |
| S.D. | 6.6 | 10.9 | 8.9 | 8.4 | 10.9 | 11.8 | 11.7 | 6.6 | 6.4 | 7.8 |

Temporary Threshold Shift (dB): 2075 Hz center frequency, 134 dB Peak SPL

Frequency 0.125 kHz

| Animal\day | 0. | .042 | .125 | .25 | 1. | 2. | 6. | 9. | 13. | 16. | 20. | 23. | 27. | 29. | 30. | Max |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S70 | 27.5 | 12.5 | 22.5 | 22.5 | 22.5 | 17.5 | 12.5 | 22.5 | 12.5 | 17.5 | 17.5 | 17.5 | 22.5 | 22.5 | 22.5 | 27.5 |
| T71 | 22.5 | 22.5 | 22.5 | 22.5 | 27.5 | 17.5 | 17.5 | 22.5 | 17.5 | 22.5 | 22.5 | 22.5 | 17.5 | 17.5 | 17.5 | 27.5 |
| U86 | 16.0 | 21.0 | 16.0 | 26.0 | 16.0 | 26.0 | 16.0 | 16.0 | 16.0 | 6.0 | 16.0 | 16.0 | -4.0 | 6.0 | 16.0 | 26.0 |
| U87 | 12.5 | 27.5 | 42.5 | 47.5 | 32.5 | 47.5 | 52.5 | 27.5 | 32.5 | 37.5 | 22.5 | 7.5 | 22.5 | 22.5 | 12.5 | 52.5 |
| U91 | 27.5 | 32.5 | -12.5 | 32.5 | 32.5 | 37.5 | 22.5 | 22.5 | 27.5 | 27.5 | 22.5 | -22.5 | 17.5 | 2.5 | 27.5 | 37.5 |
| U100 | 16.0 | 21.0 | 31.0 | 36.0 | 26.0 | 1.0 | 11.0 | 1.0 | -14.0 | 6.0 | 1.0 | 11.0 | 1.0 | 6.0 | 1.0 | 36.0 |
| Mean | 20.3 | 22.8 | 20.3 | 31.2 | 26.2 | 24.5 | 22.0 | 18.7 | 15.3 | 19.5 | 17.0 | 8.7 | 12.8 | 12.8 | 16.2 | 34.5 |
| S.D. | 6.4 | 6.8 | 18.5 | 9.7 | 6.3 | 16.4 | 15.5 | 9.4 | 16.2 | 12.4 | 8.3 | 16.1 | 11.4 | 9.0 | 9.1 | 10.1 |

Frequency 0.250 kHz

| Animal\day | 0. | .042 | .125 | .25 | 1. | 2. | 6. | 9. | 13. | 16. | 20. | 23. | 27. | 29. | 30. | Max |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S70 | 17.5 | 7.5 | 12.5 | 12.5 | 12.5 | 2.5 | 7.5 | 12.5 | 12.5 | 12.5 | 17.5 | 22.5 | 2.5 | 17.5 | 12.5 | 22.5 |
| T71 | 17.5 | 12.5 | 12.5 | 22.5 | 12.5 | 12.5 | 12.5 | 17.5 | 12.5 | 12.5 | 12.5 | 12.5 | 2.5 | 12.5 | -2.5 | 22.5 |
| U86 | 18.0 | 18.0 | 23.0 | 33.0 | 18.0 | 33.0 | 23.0 | 18.0 | 18.0 | -2.0 | 3.0 | 28.0 | 3.0 | 13.0 | 23.0 | 33.0 |
| U87 | 32.5 | 12.5 | 27.5 | 42.5 | 37.5 | 27.5 | 32.5 | 42.5 | 62.5 | -2.5 | 32.5 | 32.5 | 12.5 | 42.5 | 32.5 | 62.5 |
| U91 | 27.5 | 32.5 | 32.5 | 12.5 | 17.5 | 17.5 | 27.5 | 22.5 | 12.5 | 17.5 | 12.5 | 12.5 | 12.5 | 7.5 | 7.5 | 32.5 |
| U100 | 27.0 | 27.0 | 42.0 | 47.0 | 27.0 | 17.0 | 17.0 | 7.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | -8.0 | -13.0 | 47.0 |
| Mean | 23.3 | 18.3 | 25.0 | 28.3 | 20.8 | 18.3 | 20.0 | 20.0 | 20.0 | 6.7 | 13.3 | 18.3 | 5.8 | 14.2 | 10.0 | 36.7 |
| S.D. | 6.5 | 9.6 | 11.6 | 14.9 | 9.7 | 10.8 | 9.4 | 12.2 | 21.5 | 8.6 | 11.1 | 11.4 | 5.2 | 16.5 | 16.6 | 15.5 |

Frequency 0.500 kHz

| Animal\day | 0. | .042 | .125 | .25 | 1. | 2. | 6. | 9. | 13. | 16. | 20. | 23. | 27. | 29. | 30. | Max |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S70 | 12.5 | 7.5 | 7.5 | 7.5 | 12.5 | 2.5 | 12.5 | 12.5 | -7.5 | 7.5 | 2.5 | 7.5 | 7.5 | 7.5 | 12.5 | 12.5 |
| T71 | 12.5 | 12.5 | 7.5 | 7.5 | 12.5 | 7.5 | 7.5 | 7.5 | 2.5 | 2.5 | 12.5 | 2.5 | 2.5 | 7.5 | 2.5 | 12.5 |
| U86 | 9.0 | 14.0 | 14.0 | 19.0 | 14.0 | 24.0 | 14.0 | -1.0 | 44.0 | -16.0 | 14.0 | 29.0 | -1.0 | 4.0 | 19.0 | 44.0 |
| U87 | 27.5 | 12.5 | -7.5 | 57.5 | 32.5 | 27.5 | 42.5 | -2.5 | 37.5 | 12.5 | 22.5 | 27.5 | 27.5 | 12.5 | 42.5 | 57.5 |
| U91 | 12.5 | 7.5 | 12.5 | 12.5 | 12.5 | 22.5 | 12.5 | -2.5 | 2.5 | -7.5 | -7.5 | 2.5 | 2.5 | 2.5 | 2.5 | 22.5 |
| U100 | 33.0 | 33.0 | 38.0 | 38.0 | 13.0 | 28.0 | 3.0 | 13.0 | 13.0 | 3.0 | 8.0 | 13.0 | 8.0 | 13.0 | 13.0 | 38.0 |
| Mean | 17.8 | 14.5 | 12.0 | 23.7 | 16.2 | 18.7 | 15.3 | 4.5 | 15.3 | 0.3 | 8.7 | 13.7 | 7.8 | 7.8 | 15.3 | 31.2 |
| S.D. | 9.9 | 9.5 | 14.8 | 20.1 | 8.0 | 10.9 | 13.9 | 7.4 | 20.8 | 10.4 | 10.3 | 12.0 | 10.2 | 4.3 | 14.8 | 18.3 |

Temporary Threshold Shift (dB): 2075 Hz center frequency, 134 dB Peak SPL

Frequency 1.000 kHz

| Animal\day | 0. | .042 | .125 | .25 | 1. | 2. | 6. | 9. | 13. | 16. | 20. | 23. | 27. | 29. | 30. | Max |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S70 | 7.5 | 7.5 | 2.5 | 2.5 | -2.5 | -2.5 | 12.5 | 7.5 | -2.5 | -7.5 | 2.5 | 12.5 | 12.5 | 12.5 | 12.5 | 12.5 |
| T71 | -2.5 | 7.5 | -7.5 | -7.5 | 7.5 | -7.5 | 2.5 | -2.5 | -2.5 | 12.5 | 2.5 | 2.5 | -2.5 | 2.5 | 2.5 | 12.5 |
| U86 | 32.0 | 17.0 | 27.0 | 32.0 | 27.0 | 32.0 | 27.0 | 12.0 | 7.0 | 12.0 | 7.0 | 2.0 | 2.0 | 12.0 | 12.0 | 32.0 |
| U87 | 27.5 | 32.5 | 7.5 | 32.5 | 57.5 | 12.5 | 47.5 | 32.5 | 17.5 | 7.5 | 12.5 | 32.5 | 12.5 | 32.5 | 37.5 | 57.5 |
| U91 | -7.5 | 12.5 | 7.5 | 12.5 | 17.5 | -2.5 | 17.5 | 7.5 | -7.5 | 7.5 | 12.5 | 2.5 | 2.5 | 12.5 | -2.5 | 17.5 |
| U100 | 28.0 | 38.0 | 58.0 | 48.0 | 33.0 | 48.0 | 28.0 | 28.0 | 13.0 | 3.0 | -7.0 | 13.0 | 13.0 | 8.0 | 8.0 | 58.0 |
| Mean | 14.2 | 19.2 | 15.8 | 20.0 | 23.3 | 13.3 | 22.5 | 14.2 | 4.2 | 5.8 | 5.0 | 10.8 | 6.7 | 13.3 | 11.7 | 31.7 |
| S.D. | 17.2 | 13.1 | 23.5 | 21.0 | 21.1 | 22.3 | 15.5 | 13.4 | 9.9 | 7.4 | 7.4 | 11.8 | 6.8 | 10.2 | 13.9 | 21.4 |

Frequency 1.400 kHz

| Animal\day | 0. | .042 | .125 | .25 | 1. | 2. | 6. | 9. | 13. | 16. | 20. | 23. | 27. | 29. | 30. | Max |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S70 | 2.5 | 7.5 | 12.5 | -12.5 | 2.5 | -2.5 | 7.5 | 12.5 | -7.5 | 2.5 | 7.5 | -7.5 | 2.5 | 7.5 | 12.5 | 12.5 |
| T71 | -2.5 | 2.5 | -7.5 | -7.5 | 7.5 | -2.5 | 7.5 | 2.5 | 2.5 | -7.5 | 12.5 | -7.5 | 2.5 | 2.5 | 2.5 | 12.5 |
| U86 | 39.0 | 44.0 | 49.0 | 14.0 | 44.0 | 29.0 | 39.0 | 24.0 | 34.0 | 29.0 | 14.0 | 14.0 | 9.0 | 24.0 | 14.0 | 49.0 |
| U87 | 32.5 | 32.5 | 42.5 | 27.5 | 12.5 | 27.5 | 37.5 | 42.5 | 47.5 | 47.5 | -7.5 | 57.5 | 27.5 | 32.5 | 12.5 | 57.5 |
| U91 | 37.5 | 7.5 | 22.5 | 17.5 | -7.5 | 22.5 | 27.5 | 17.5 | 2.5 | 7.5 | 12.5 | 2.5 | -2.5 | 7.5 | 12.5 | 37.5 |
| U100 | 22.0 | 22.0 | 47.0 | 52.0 | 27.0 | 2.0 | 27.0 | 12.0 | 2.0 | -13.0 | -8.0 | -13.0 | -3.0 | -8.0 | -3.0 | 52.0 |
| Mean | 21.8 | 19.3 | 27.7 | 15.2 | 14.3 | 12.7 | 24.3 | 18.5 | 13.5 | 11.0 | 5.2 | 7.7 | 6.0 | 11.0 | 8.5 | 36.8 |
| S.D. | 18.0 | 16.4 | 22.5 | 23.6 | 18.5 | 15.2 | 13.9 | 13.7 | 21.9 | 23.1 | 10.2 | 26.2 | 11.4 | 14.8 | 7.0 | 19.9 |

Frequency 2.000 kHz

| Animal\day | 0. | .042 | .125 | .25 | 1. | 2. | 6. | 9. | 13. | 16. | 20. | 23. | 27. | 29. | 30. | Max |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S70 | -2.5 | 12.5 | -2.5 | 2.5 | -7.5 | -7.5 | 2.5 | -2.5 | -2.5 | -2.5 | -2.5 | -7.5 | 2.5 | 2.5 | -7.5 | 12.5 |
| T71 | 2.5 | 2.5 | -2.5 | 2.5 | -2.5 | -7.5 | 12.5 | 2.5 | 2.5 | -7.5 | 7.5 | 12.5 | -7.5 | 2.5 | -2.5 | 12.5 |
| U86 | 23.0 | 3.0 | 43.0 | 33.0 | 48.0 | 38.0 | 28.0 | 18.0 | 23.0 | 8.0 | 23.0 | 13.0 | 3.0 | 8.0 | 23.0 | 48.0 |
| U87 | 12.5 | 22.5 | 47.5 | 57.5 | 57.5 | 57.5 | 32.5 | 27.5 | 52.5 | -12.5 | 32.5 | 22.5 | 7.5 | 32.5 | 37.5 | 57.5 |
| U91 | 12.5 | 17.5 | 27.5 | 12.5 | 2.5 | 22.5 | 22.5 | 12.5 | 12.5 | 12.5 | 7.5 | 2.5 | 2.5 | -7.5 | -2.5 | 27.5 |
| U100 | 13.0 | 28.0 | 63.0 | 48.0 | 33.0 | 18.0 | 18.0 | 13.0 | -12.0 | -7.0 | -2.0 | -7.0 | -2.0 | -7.0 | -2.0 | 63.0 |
| Mean | 10.2 | 14.3 | 29.3 | 26.0 | 21.8 | 20.2 | 19.3 | 11.8 | 12.7 | -1.5 | 11.0 | 6.0 | 1.0 | 5.2 | 7.7 | 36.8 |
| S.D. | 9.0 | 10.3 | 27.1 | 23.7 | 28.0 | 25.5 | 10.9 | 10.8 | 23.0 | 9.7 | 14.0 | 12.1 | 5.1 | 14.7 | 18.2 | 22.4 |

Temporary Threshold Shift (dB): 2075 Hz center frequency, 134 dB Peak SPL

Frequency 2.800 kHz

| Animal\day | 0. | .042 | .125 | .25 | 1. | 2. | 6. | 9. | 13. | 16. | 20. | 23. | 27. | 29. | 30. | Max |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S70 | 2.5 | -2.5 | 2.5 | 12.5 | 2.5 | 2.5 | -7.5 | -7.5 | -7.5 | -2.5 | -7.5 | -2.5 | -2.5 | 17.5 | -2.5 | 17.5 |
| T71 | 12.5 | 12.5 | 12.5 | 12.5 | 12.5 | 2.5 | 2.5 | 7.5 | 7.5 | 17.5 | 7.5 | 7.5 | 2.5 | 7.5 | 7.5 | 17.5 |
| U86 | 12.0 | 27.0 | 37.0 | 42.0 | 12.0 | 47.0 | 22.0 | 12.0 | 22.0 | 2.0 | 12.0 | 12.0 | 12.0 | 2.0 | 22.0 | 47.0 |
| U87 | 12.5 | 32.5 | 32.5 | 47.5 | 32.5 | 32.5 | 17.5 | 27.5 | 52.5 | 7.5 | 32.5 | 32.5 | 37.5 | 32.5 | 22.5 | 52.5 |
| U91 | 7.5 | 7.5 | 17.5 | 27.5 | 12.5 | 2.5 | 22.5 | 22.5 | 12.5 | -7.5 | 12.5 | 12.5 | 2.5 | 12.5 | 7.5 | 27.5 |
| U100 | 19.0 | 29.0 | 54.0 | 64.0 | 24.0 | 19.0 | 19.0 | 9.0 | 4.0 | -1.0 | -11.0 | 4.0 | 4.0 | -1.0 | -1.0 | 64.0 |
| Mean | 11.0 | 17.7 | 26.0 | 34.3 | 16.0 | 17.7 | 12.7 | 11.8 | 15.2 | 2.7 | 7.7 | 11.0 | 9.3 | 11.8 | 9.3 | 37.7 |
| S.D. | 5.5 | 13.9 | 18.7 | 20.6 | 10.6 | 18.8 | 12.3 | 12.3 | 20.7 | 8.8 | 15.7 | 11.9 | 14.6 | 12.2 | 10.8 | 19.6 |

Frequency 4.000 kHz

| Animal\day | 0. | .042 | .125 | .25 | 1. | 2. | 6. | 9. | 13. | 16. | 20. | 23. | 27. | 29. | 30. | Max |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S70 | -7.5 | -2.5 | -7.5 | -7.5 | -12.5 | -12.5 | -2.5 | -7.5 | -7.5 | 2.5 | -7.5 | -7.5 | -7.5 | -7.5 | 7.5 | 7.5 |
| T71 | 12.5 | 7.5 | 2.5 | -7.5 | 12.5 | 2.5 | 7.5 | 7.5 | 2.5 | 12.5 | 2.5 | 7.5 | -2.5 | 2.5 | 2.5 | 12.5 |
| U86 | 14.0 | 14.0 | 14.0 | 24.0 | 24.0 | 4.0 | 4.0 | 14.0 | 9.0 | 9.0 | 14.0 | 9.0 | 9.0 | 4.0 | 9.0 | 24.0 |
| U87 | -7.5 | 12.5 | 7.5 | 47.5 | 52.5 | 37.5 | 52.5 | 32.5 | 32.5 | 32.5 | 27.5 | 2.5 | -2.5 | 17.5 | 22.5 | 52.5 |
| U91 | 7.5 | 7.5 | 2.5 | 22.5 | 2.5 | 12.5 | 12.5 | 12.5 | 2.5 | -2.5 | 2.5 | 2.5 | 12.5 | -7.5 | -2.5 | 22.5 |
| U100 | 12.0 | 22.0 | 67.0 | 42.0 | 22.0 | 12.0 | 2.0 | 2.0 | -8.0 | 2.0 | -3.0 | 2.0 | 12.0 | -8.0 | -8.0 | 67.0 |
| Mean | 5.2 | 10.2 | 14.3 | 20.2 | 16.8 | 9.3 | 12.7 | 10.2 | 5.2 | 9.3 | 6.0 | 2.7 | 3.5 | 0.2 | 5.2 | 31.0 |
| S.D. | 10.0 | 8.2 | 26.7 | 23.6 | 22.1 | 16.5 | 20.2 | 13.5 | 14.9 | 12.5 | 12.8 | 5.8 | 8.7 | 10.0 | 10.6 | 23.6 |

Frequency 5.700 kHz

| Animal\day | 0. | .042 | .125 | .25 | 1. | 2. | 6. | 9. | 13. | 16. | 20. | 23. | 27. | 29. | 30. | Max |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S70 | 7.5 | 2.5 | 12.5 | 2.5 | 2.5 | -7.5 | 2.5 | 2.5 | 2.5 | 2.5 | 7.5 | 2.5 | 12.5 | 7.5 | 7.5 | 12.5 |
| T71 | 2.5 | -2.5 | 2.5 | 2.5 | 7.5 | 7.5 | 7.5 | 12.5 | 2.5 | 12.5 | -2.5 | 2.5 | 2.5 | 7.5 | -2.5 | 12.5 |
| U86 | 8.0 | 18.0 | 8.0 | 13.0 | 3.0 | 43.0 | 18.0 | 13.0 | 38.0 | 3.0 | 23.0 | -2.0 | -2.0 | -2.0 | -2.0 | 43.0 |
| U87 | 2.5 | 12.5 | 57.5 | 62.5 | 52.5 | 32.5 | 62.5 | 12.5 | 37.5 | 32.5 | 12.5 | 12.5 | 17.5 | 17.5 | 22.5 | 62.5 |
| U91 | 12.5 | 17.5 | 17.5 | 12.5 | 12.5 | 2.5 | 22.5 | 2.5 | 7.5 | 7.5 | 12.5 | 17.5 | -7.5 | 2.5 | 7.5 | 22.5 |
| U100 | 1.0 | 31.0 | 31.0 | 51.0 | 16.0 | 1.0 | 1.0 | -9.0 | 6.0 | -4.0 | 1.0 | 1.0 | -4.0 | -4.0 | -4.0 | 51.0 |
| Mean | 5.7 | 13.2 | 21.5 | 24.0 | 15.7 | 13.2 | 19.0 | 5.7 | 15.7 | 9.0 | 9.0 | 5.7 | 3.2 | 4.8 | 4.8 | 34.0 |
| S.D. | 4.4 | 12.0 | 20.1 | 26.0 | 18.8 | 19.9 | 23.0 | 8.7 | 17.2 | 12.8 | 9.2 | 7.6 | 9.8 | 7.8 | 10.0 | 21.2 |

Temporary Threshold Shift (dB): 2075 Hz center frequency, 134 dB Peak SPL

Frequency 8.000 kHz

| Animal\day | 0. | .042 | .125 | .25 | 1. | 2. | 6. | 9. | 13. | 16. | 20. | 23. | 27. | 29. | 30. | Max |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S70 | 7.5 | 7.5 | 2.5 | 2.5 | 2.5 | 12.5 | 7.5 | 7.5 | 2.5 | 12.5 | 12.5 | 2.5 | 12.5 | 2.5 | 12.5 | 12.5 |
| T71 | 12.5 | 12.5 | -2.5 | -2.5 | 7.5 | 2.5 | 12.5 | 12.5 | 2.5 | 7.5 | 2.5 | -2.5 | 12.5 | 2.5 | -2.5 | 12.5 |
| U86 | 11.0 | 11.0 | 11.0 | 11.0 | 31.0 | 26.0 | 21.0 | 16.0 | 16.0 | 1.0 | 11.0 | 11.0 | 6.0 | 6.0 | 11.0 | 31.0 |
| U87 | -7.5 | 7.5 | 2.5 | 47.5 | 22.5 | 47.5 | 47.5 | -7.5 | 12.5 | 22.5 | 2.5 | 2.5 | 12.5 | 17.5 | 12.5 | 47.5 |
| U91 | 12.5 | 7.5 | 12.5 | 12.5 | 2.5 | -2.5 | 12.5 | 2.5 | 12.5 | 7.5 | 2.5 | 12.5 | 7.5 | 2.5 | -7.5 | 12.5 |
| U100 | -2.0 | 3.0 | 48.0 | 38.0 | 3.0 | 3.0 | -7.0 | -7.0 | 3.0 | -7.0 | -17.0 | -7.0 | -17.0 | -2.0 | -12.0 | 48.0 |
| Mean | 5.7 | 8.2 | 12.3 | 18.2 | 11.5 | 14.8 | 15.7 | 4.0 | 8.2 | 7.3 | 2.3 | 3.2 | 5.7 | 4.8 | 2.3 | 27.3 |
| S.D. | 8.5 | 3.3 | 18.4 | 20.0 | 12.3 | 18.9 | 18.1 | 9.8 | 6.2 | 10.0 | 10.5 | 7.5 | 11.5 | 6.7 | 11.0 | 17.4 |

Summary of group anatomical data

with cochleograms and PTS audiograms

for individual animals

2075 Hz center frequency, 134 dB peak SPL

Total number of cochlear sensory cells missing

| Animal number | Inner hair cells | 1st row outer hair cells | 2nd row outer hair cells | 3rd row outer hair cells | Total outer hair cells |
|---|---|---|---|---|---|
| S70 | 18 | 84 | 99 | 159 | 342 |
| T71 | 5 | 45 | 61 | 143 | 249 |
| U86 | 58 | 105 | 155 | 183 | 443 |
| U87 | 132 | 418 | 435 | 321 | 1174 |
| U91 | 58 | 81 | 95 | 128 | 304 |
| U100 | 76 | 163 | 174 | 273 | 610 |
| Group mean | 58 | | | | 520 |
| S.D. | 45 | | | | 345 |
| S.E. | 18 | | | | 141 |

Total sensory cell losses over octave band lengths of the cochlea centered at the frequencies indicated

| | Octave band center frequency | Inner hair cells | Outer hair cells |
|---|---|---|---|
| Group means | | | |
| | 0.125 kHz | 1.7 | 60.7 |
| | 0.25 kHz | 1.5 | 63.2 |
| | 0.5 kHz | 1.5 | 48.2 |
| | 1 kHz | 37.0 | 195.5 |
| | 2 kHz | 11.7 | 88.2 |
| | 4 kHz | 2.3 | 22.0 |
| | 8 kHz | 1.2 | 18.7 |
| | 16 kHz | 1.0 | 24.0 |
| Standard deviations | | | |
| | 0.125 kHz | 1.5 | 26.3 |
| | 0.25 kHz | 1.6 | 24.9 |
| | 0.5 kHz | 2.3 | 28.7 |
| | 1 kHz | 37.3 | 197.5 |
| | 2 kHz | 16.5 | 128.5 |
| | 4 kHz | 2.0 | 22.4 |
| | 8 kHz | 1.9 | 14.9 |
| | 16 kHz | 2.0 | 27.7 |

2075 Hz center frequency, 134 dB peak SPL

Total sensory cell losses over octave band frequencies

| | Inner hair cells | 1st row outer hair cells | 2nd row outer hair cells | 3rd row outer hair cells | Comb. outer hair cells | Inner pillar cells | Outer pillar cells |
|---|---|---|---|---|---|---|---|
| **Chinchilla S70** | | | | | | | |
| 0.125 kHz | 1 | 15 | 24 | 55 | 94 | 0 | 2 |
| 0.25 kHz | 3 | 11 | 11 | 30 | 52 | 0 | 1 |
| 0.5 kHz | 1 | 14 | 24 | 14 | 52 | 0 | 0 |
| 1 kHz | 2 | 3 | 10 | 9 | 22 | 0 | 0 |
| 2 kHz | 2 | 9 | 4 | 5 | 18 | 0 | 0 |
| 4 kHz | 3 | 7 | 4 | 6 | 17 | 1 | 0 |
| 8 kHz | 1 | 5 | 1 | 7 | 13 | 0 | 0 |
| 16 kHz | 5 | 20 | 21 | 33 | 74 | 0 | 0 |
| TOTALS | 18 | 84 | 99 | 159 | 342 | 1 | 3 |
| **Chinchilla T71** | | | | | | | |
| 0.125 kHz | 3 | 8 | 13 | 39 | 60 | 2 | 1 |
| 0.25 kHz | 0 | 4 | 4 | 42 | 50 | 0 | 0 |
| 0.5 kHz | 1 | 20 | 28 | 35 | 83 | 0 | 0 |
| 1 kHz | 0 | 3 | 4 | 7 | 14 | 0 | 0 |
| 2 kHz | 0 | 3 | 6 | 10 | 19 | 0 | 0 |
| 4 kHz | 1 | 2 | 2 | 4 | 8 | 0 | 0 |
| 8 kHz | 0 | 3 | 3 | 4 | 10 | 0 | 0 |
| 16 kHz | 0 | 2 | 1 | 2 | 5 | 0 | 0 |
| TOTALS | 5 | 45 | 61 | 143 | 249 | 2 | 1 |
| **Chinchilla U86** | | | | | | | |
| 0.125 kHz | 1 | 2 | 3 | 18 | 23 | 0 | 0 |
| 0.25 kHz | 0 | 7 | 20 | 29 | 56 | 0 | 0 |
| 0.5 kHz | 1 | 4 | 28 | 18 | 50 | 0 | 0 |
| 1 kHz | 47 | 76 | 83 | 74 | 233 | 95 | 65 |
| 2 kHz | 3 | 6 | 6 | 9 | 21 | 0 | 0 |
| 4 kHz | 5 | 4 | 8 | 6 | 18 | 0 | 0 |
| 8 kHz | 1 | 5 | 6 | 29 | 40 | 0 | 0 |
| 16 kHz | 0 | 1 | 1 | 0 | 2 | 0 | 0 |
| TOTALS | 58 | 105 | 155 | 183 | 443 | 95 | 65 |

2075 Hz center frequency, 134 dB peak SPL

Total sensory cell losses over octave band frequencies

| | Inner hair cells | 1st row outer hair cells | 2nd row outer hair cells | 3rd row outer hair cells | Comb. outer hair cells | Inner pillar cells | Outer pillar cells |
|---|---|---|---|---|---|---|---|
| **Chinchilla U87** | | | | | | | |
| 0.125 kHz | 1 | 8 | 13 | 27 | 48 | 0 | 1 |
| 0.25 kHz | 1 | 8 | 33 | 47 | 88 | 0 | 0 |
| 0.5 kHz | 0 | 22 | 30 | 22 | 74 | 0 | 1 |
| 1 kHz | 87 | 251 | 145 | 115 | 511 | 165 | 105 |
| 2 kHz | 42 | 97 | 159 | 86 | 342 | 69 | 57 |
| 4 kHz | 1 | 18 | 43 | 6 | 67 | 0 | 0 |
| 8 kHz | 0 | 8 | 10 | 17 | 35 | 0 | 0 |
| 16 kHz | 0 | 6 | 2 | 1 | 9 | 0 | 0 |
| TOTALS | 132 | 418 | 435 | 321 | 1174 | 234 | 164 |
| **Chinchilla U91** | | | | | | | |
| 0.125 kHz | 4 | 8 | 20 | 24 | 52 | 0 | 0 |
| 0.25 kHz | 4 | 4 | 9 | 21 | 34 | 0 | 0 |
| 0.5 kHz | 6 | 2 | 2 | 9 | 13 | 0 | 0 |
| 1 kHz | 14 | 21 | 19 | 32 | 72 | 25 | 15 |
| 2 kHz | 20 | 36 | 35 | 31 | 102 | 48 | 29 |
| 4 kHz | 4 | 2 | 4 | 3 | 9 | 0 | 0 |
| 8 kHz | 5 | 1 | 0 | 5 | 6 | 0 | 0 |
| 16 kHz | 1 | 7 | 6 | 3 | 16 | 0 | 0 |
| TOTALS | 58 | 81 | 95 | 128 | 304 | 73 | 44 |
| **Chinchilla U100** | | | | | | | |
| 0.125 kHz | 0 | 4 | 28 | 55 | 87 | 0 | 0 |
| 0.25 kHz | 1 | 10 | 14 | 75 | 99 | 0 | 0 |
| 0.5 kHz | 0 | 5 | 2 | 10 | 17 | 0 | 1 |
| 1 kHz | 72 | 113 | 105 | 103 | 321 | 155 | 101 |
| 2 kHz | 3 | 13 | 8 | 6 | 27 | 4 | 8 |
| 4 kHz | 0 | 4 | 3 | 6 | 13 | 0 | 0 |
| 8 kHz | 0 | 3 | 2 | 3 | 8 | 0 | 0 |
| 16 kHz | 0 | 11 | 12 | 15 | 38 | 0 | 0 |
| TOTALS | 76 | 163 | 174 | 273 | 610 | 159 | 110 |

2075 Hz center frequency, 134 dB peak SPL

Total sensory cell losses over octave band frequencies

| | Inner hair cells | 1st row outer hair cells | 2nd row outer hair cells | 3rd row outer hair cells | Comb. outer hair cells | Inner pillar cells | Outer pillar cells |
|---|---|---|---|---|---|---|---|
| **Group means** | | | | | | | |
| 0.125 kHz | 1.7 | 7.5 | 16.8 | 36.3 | 60.7 | 0.3 | 0.7 |
| 0.25 kHz | 1.5 | 7.3 | 15.2 | 40.7 | 63.2 | 0.0 | 0.2 |
| 0.5 kHz | 1.5 | 11.2 | 19.0 | 18.0 | 48.2 | 0.0 | 0.3 |
| 1 kHz | 37.0 | 77.8 | 61.0 | 56.7 | 195.5 | 73.3 | 47.7 |
| 2 kHz | 11.7 | 27.3 | 36.3 | 24.5 | 88.2 | 20.2 | 15.7 |
| 4 kHz | 2.3 | 6.2 | 10.7 | 5.2 | 22.0 | 0.2 | 0.0 |
| 8 kHz | 1.2 | 4.2 | 3.7 | 10.8 | 18.7 | 0.0 | 0.0 |
| 16 kHz | 1.0 | 7.8 | 7.2 | 9.0 | 24.0 | 0.0 | 0.0 |
| TOTALS | 57.8 | 149.3 | 169.8 | 201.2 | 520.3 | 94.0 | 64.5 |
| **Group standard deviations** | | | | | | | |
| 0.125 kHz | 1.5 | 4.5 | 9.0 | 16.0 | 26.3 | 0.8 | 0.8 |
| 0.25 kHz | 1.6 | 2.9 | 10.2 | 19.3 | 24.9 | 0.0 | 0.4 |
| 0.5 kHz | 2.3 | 8.7 | 13.3 | 9.7 | 28.7 | 0.0 | 0.5 |
| 1 kHz | 37.3 | 95.6 | 58.5 | 47.3 | 197.5 | 75.7 | 49.1 |
| 2 kHz | 16.5 | 36.1 | 61.2 | 31.6 | 128.5 | 30.5 | 23.2 |
| 4 kHz | 2.0 | 6.1 | 16.0 | 1.3 | 22.4 | 0.4 | 0.0 |
| 8 kHz | 1.9 | 2.4 | 3.7 | 10.2 | 14.9 | 0.0 | 0.0 |
| 16 kHz | 2.0 | 7.0 | 8.0 | 13.0 | 27.7 | 0.0 | 0.0 |
| TOTALS | 45.2 | 137.2 | 136.4 | 77.9 | 344.5 | 91.0 | 63.6 |

2075 Hz center frequency, 134 dB peak SPL

Percent sensory cell losses over octave band frequencies

| | Inner hair cells | 1st row outer hair cells | 2nd row outer hair cells | 3rd row outer hair cells | Comb. outer hair cells | Inner pillar cells | Outer pillar cells |
|---|---|---|---|---|---|---|---|
| **Chinchilla S70** | | | | | | | |
| 0.125 kHz | 0.7 | 7.6 | 12.2 | 27.9 | 15.9 | 0.0 | 1.0 |
| 0.25 kHz | 1.1 | 3.2 | 3.2 | 8.7 | 5.0 | 0.0 | 0.3 |
| 0.5 kHz | 0.4 | 4.1 | 7.0 | 4.1 | 5.1 | 0.0 | 0.0 |
| 1 kHz | 0.8 | 0.9 | 3.0 | 2.7 | 2.2 | 0.0 | 0.0 |
| 2 kHz | 0.8 | 2.7 | 1.2 | 1.5 | 1.8 | 0.0 | 0.0 |
| 4 kHz | 1.1 | 2.1 | 1.2 | 1.8 | 1.7 | 0.2 | 0.0 |
| 8 kHz | 0.4 | 1.5 | 0.3 | 2.1 | 1.3 | 0.0 | 0.0 |
| 16 kHz | 2.1 | 6.7 | 7.0 | 11.0 | 8.2 | 0.0 | 0.0 |
| **Chinchilla T71** | | | | | | | |
| 0.125 kHz | 2.2 | 4.4 | 7.2 | 21.7 | 11.1 | 0.7 | 0.6 |
| 0.25 kHz | 0.0 | 1.3 | 1.3 | 13.3 | 5.3 | 0.0 | 0.0 |
| 0.5 kHz | 0.4 | 6.3 | 8.9 | 11.1 | 8.8 | 0.0 | 0.0 |
| 1 kHz | 0.0 | 1.0 | 1.3 | 2.3 | 1.5 | 0.0 | 0.0 |
| 2 kHz | 0.0 | 1.0 | 2.0 | 3.3 | 2.1 | 0.0 | 0.0 |
| 4 kHz | 0.4 | 0.7 | 0.7 | 1.3 | 0.9 | 0.0 | 0.0 |
| 8 kHz | 0.0 | 1.0 | 1.0 | 1.3 | 1.1 | 0.0 | 0.0 |
| 16 kHz | 0.0 | 0.7 | 0.4 | 0.7 | 0.6 | 0.0 | 0.0 |
| **Chinchilla U86** | | | | | | | |
| 0.125 kHz | 0.7 | 1.1 | 1.6 | 9.7 | 4.1 | 0.0 | 0.0 |
| 0.25 kHz | 0.0 | 2.1 | 6.1 | 8.9 | 5.7 | 0.0 | 0.0 |
| 0.5 kHz | 0.4 | 1.2 | 8.6 | 5.5 | 5.1 | 0.0 | 0.0 |
| 1 kHz | 19.6 | 24.5 | 26.8 | 23.9 | 25.1 | 19.0 | 21.0 |
| 2 kHz | 1.3 | 1.9 | 1.9 | 2.8 | 2.2 | 0.0 | 0.0 |
| 4 kHz | 2.0 | 1.3 | 2.5 | 1.9 | 1.9 | 0.0 | 0.0 |
| 8 kHz | 0.4 | 1.6 | 1.9 | 9.1 | 4.2 | 0.0 | 0.0 |
| 16 kHz | 0.0 | 0.4 | 0.4 | 0.0 | 0.3 | 0.0 | 0.0 |

2075 Hz center frequency, 134 dB peak SPL

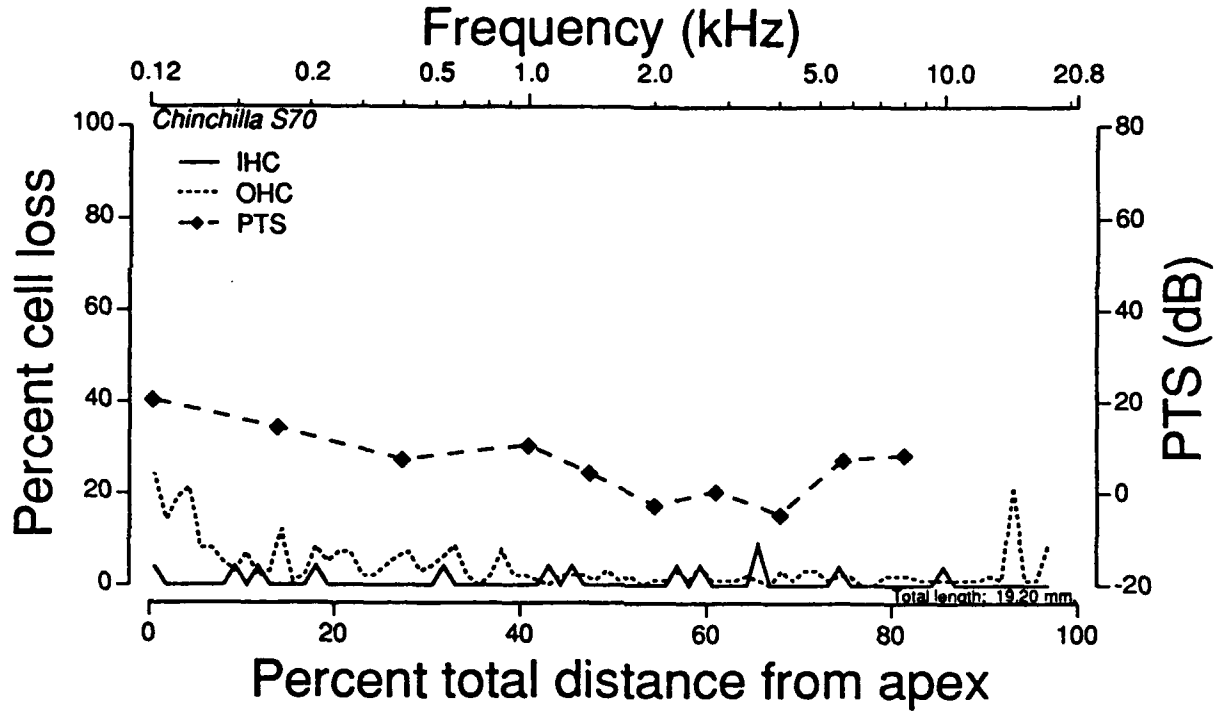
Percent sensory cell losses over octave band frequencies

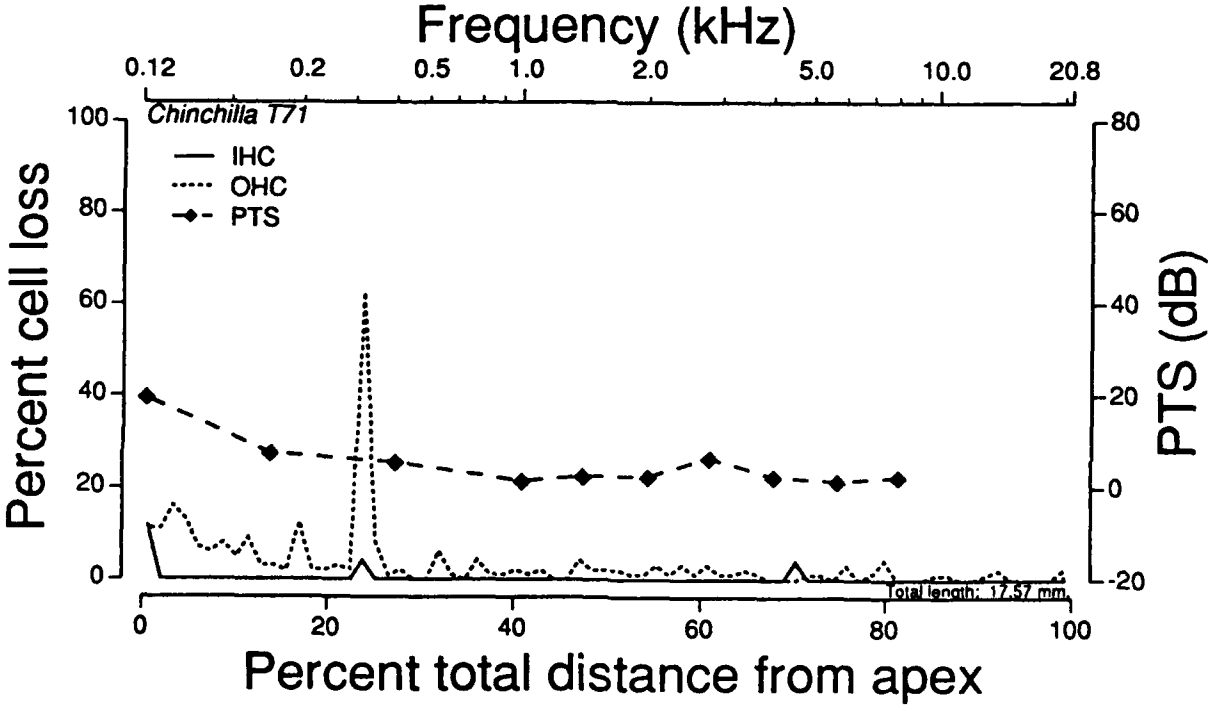
| | Inner hair cells | 1st row outer hair cells | 2nd row outer hair cells | 3rd row outer hair cells | Comb. outer hair cells | Inner pillar cells | Outer pillar cells |
|---|---|---|---|---|---|---|---|
| **Chinchilla U87** | | | | | | | |
| 0.125 kHz | 0.7 | 4.5 | 7.3 | 15.2 | 9.0 | 0.0 | 0.6 |
| 0.25 kHz | 0.4 | 2.6 | 10.6 | 15.1 | 9.4 | 0.0 | 0.0 |
| 0.5 kHz | 0.0 | 7.1 | 9.6 | 7.1 | 7.9 | 0.0 | 0.3 |
| 1 kHz | 38.0 | 84.8 | 49.0 | 38.9 | 57.6 | 34.5 | 35.5 |
| 2 kHz | 18.5 | 32.0 | 52.5 | 28.4 | 37.6 | 14.1 | 18.8 |
| 4 kHz | 0.4 | 6.0 | 14.2 | 2.0 | 7.4 | 0.0 | 0.0 |
| 8 kHz | 0.0 | 2.6 | 3.3 | 5.6 | 3.8 | 0.0 | 0.0 |
| 16 kHz | 0.0 | 2.2 | 0.7 | 0.4 | 1.1 | 0.0 | 0.0 |
| **Chinchilla U91** | | | | | | | |
| 0.125 kHz | 2.9 | 4.3 | 10.8 | 13.0 | 9.4 | 0.0 | 0.0 |
| 0.25 kHz | 1.6 | 1.2 | 2.8 | 6.5 | 3.5 | 0.0 | 0.0 |
| 0.5 kHz | 2.5 | 0.6 | 0.6 | 2.8 | 1.3 | 0.0 | 0.0 |
| 1 kHz | 5.9 | 6.8 | 6.2 | 10.4 | 7.8 | 5.0 | 4.9 |
| 2 kHz | 8.5 | 11.4 | 11.1 | 9.8 | 10.8 | 9.4 | 9.2 |
| 4 kHz | 1.6 | 0.6 | 1.3 | 1.0 | 1.0 | 0.0 | 0.0 |
| 8 kHz | 2.0 | 0.3 | 0.0 | 1.6 | 0.6 | 0.0 | 0.0 |
| 16 kHz | 0.4 | 2.5 | 2.1 | 1.1 | 1.9 | 0.0 | 0.0 |
| **Chinchilla U100** | | | | | | | |
| 0.125 kHz | 0.0 | 2.2 | 15.3 | 30.1 | 15.9 | 0.0 | 0.0 |
| 0.25 kHz | 0.4 | 3.1 | 4.4 | 23.4 | 10.3 | 0.0 | 0.0 |
| 0.5 kHz | 0.0 | 1.6 | 0.6 | 3.1 | 1.8 | 0.0 | 0.3 |
| 1 kHz | 30.4 | 37.0 | 34.4 | 33.8 | 35.1 | 31.5 | 33.1 |
| 2 kHz | 1.3 | 4.2 | 2.6 | 1.9 | 2.9 | 0.8 | 2.6 |
| 4 kHz | 0.0 | 1.3 | 1.0 | 1.9 | 1.4 | 0.0 | 0.0 |
| 8 kHz | 0.0 | 1.0 | 0.6 | 1.0 | 0.9 | 0.0 | 0.0 |
| 16 kHz | 0.0 | 4.0 | 4.3 | 5.4 | 4.6 | 0.0 | 0.0 |

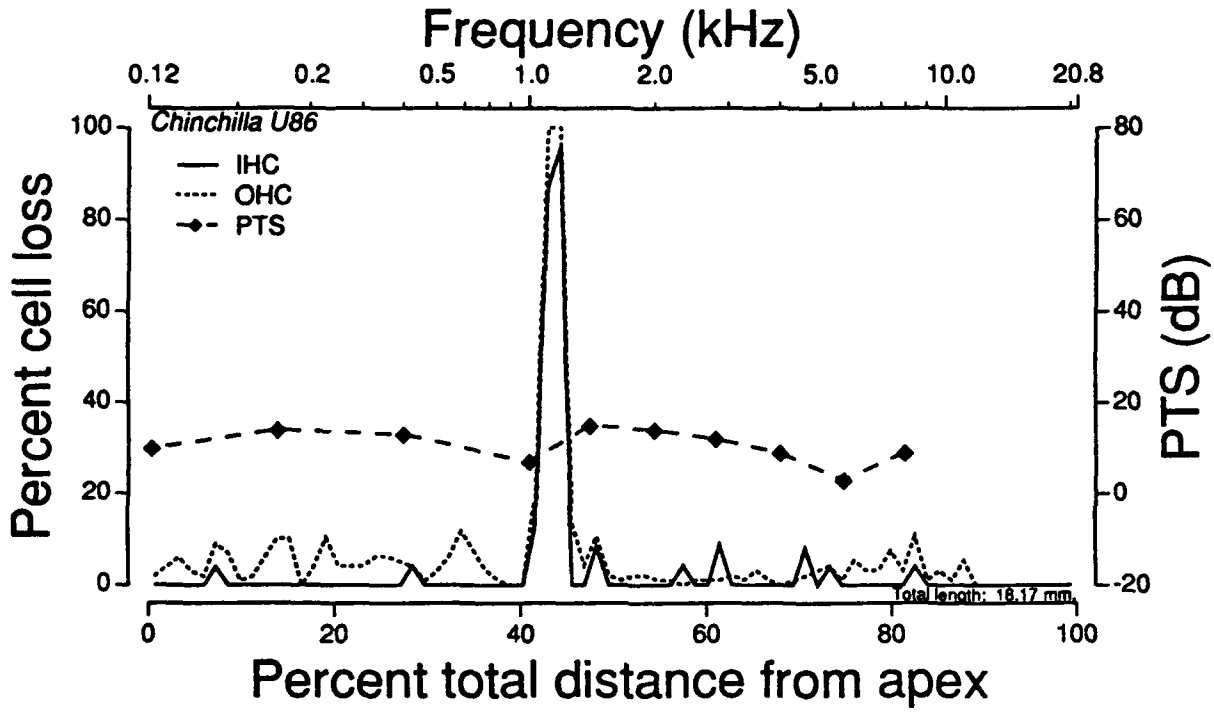
2075 Hz center frequency, 134 dB peak SPL

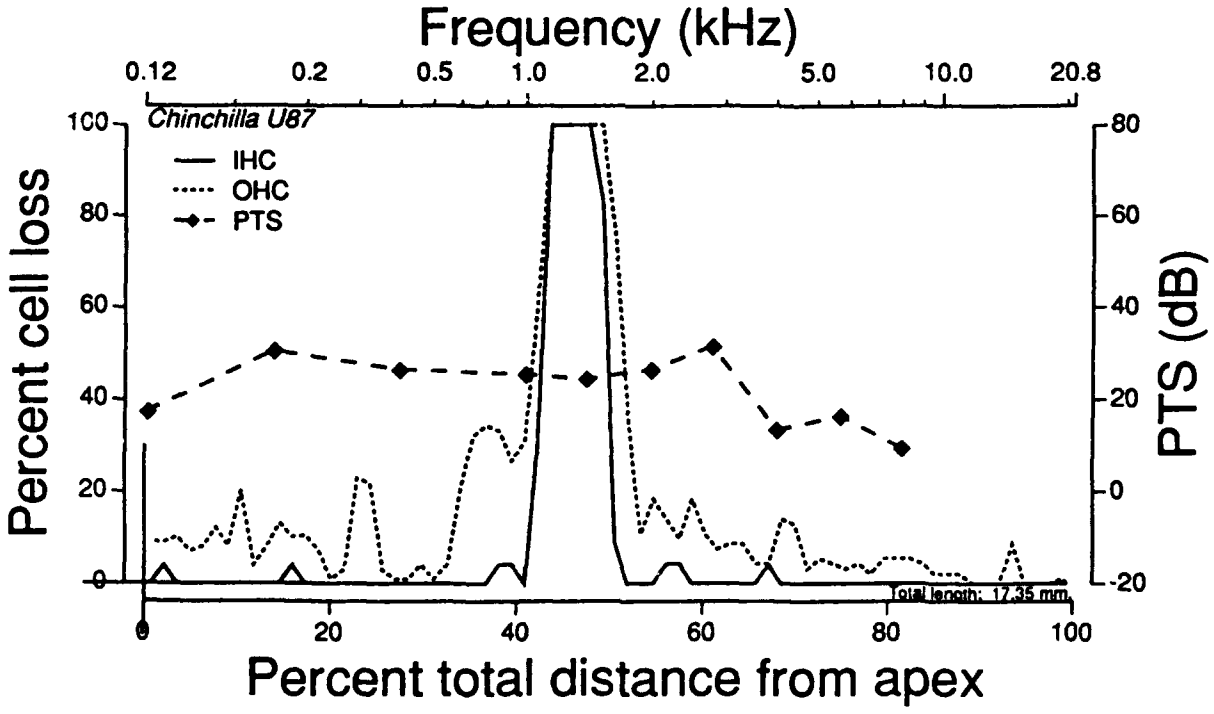
Percent sensory cell losses over octave band frequencies

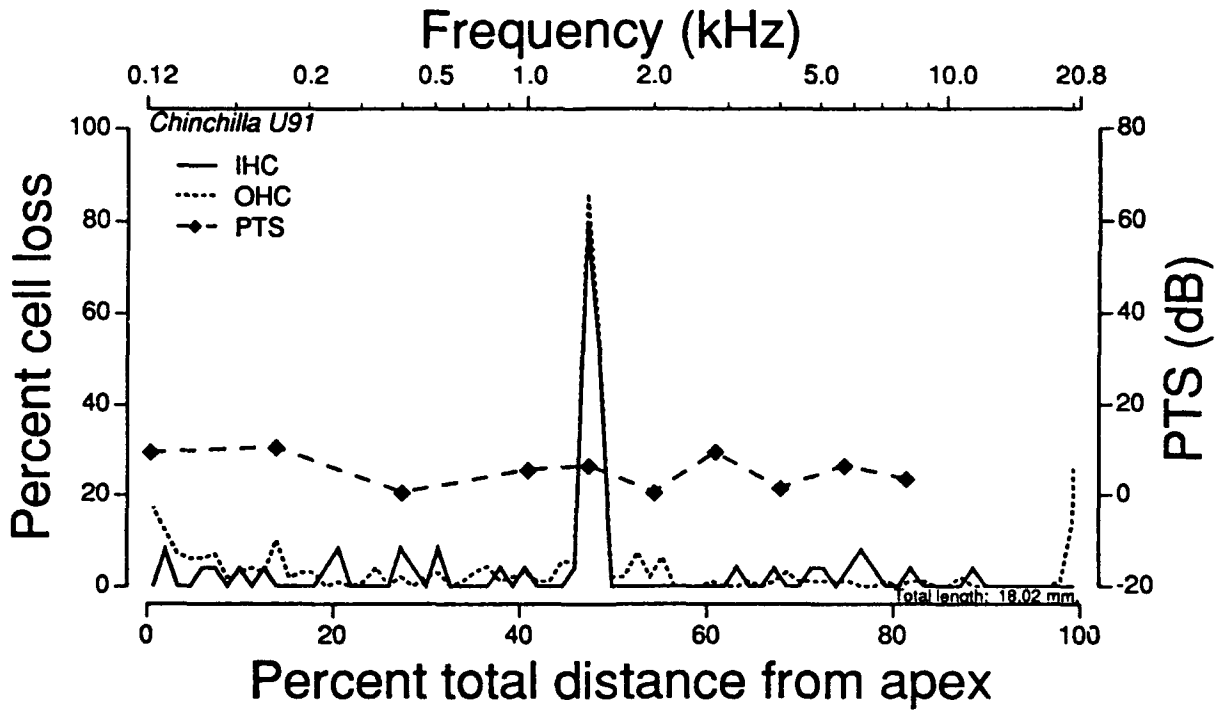
| | Inner hair cells | 1st row outer hair cells | 2nd row outer hair cells | 3rd row outer hair cells | Comb. outer hair cells | Inner pillar cells | Outer pillar cells |
|---|---|---|---|---|---|---|---|
| **Group means** | | | | | | | |
| 0.125 kHz | 1.20 | 4.02 | 9.07 | 19.60 | 10.89 | 0.12 | 0.37 |
| 0.25 kHz | 0.58 | 2.25 | 4.73 | 12.65 | 6.54 | 0.00 | 0.05 |
| 0.5 kHz | 0.62 | 3.48 | 5.88 | 5.62 | 4.99 | 0.00 | 0.10 |
| 1 kHz | 15.78 | 25.83 | 20.12 | 18.67 | 21.54 | 15.00 | 15.75 |
| 2 kHz | 5.07 | 8.87 | 11.88 | 7.95 | 9.57 | 4.05 | 5.10 |
| 4 kHz | 0.92 | 2.00 | 3.48 | 1.65 | 2.38 | 0.03 | 0.00 |
| 8 kHz | 0.47 | 1.33 | 1.18 | 3.45 | 1.99 | 0.00 | 0.00 |
| 16 kHz | 0.42 | 2.75 | 2.48 | 3.10 | 2.78 | 0.00 | 0.00 |
| **Group standard deviations** | | | | | | | |
| 0.125 kHz | 1.10 | 2.24 | 4.78 | 8.30 | 4.50 | 0.29 | 0.43 |
| 0.25 kHz | 0.64 | 0.87 | 3.29 | 6.16 | 2.69 | 0.00 | 0.12 |
| 0.5 kHz | 0.94 | 2.77 | 4.18 | 3.13 | 3.06 | 0.00 | 0.15 |
| 1 kHz | 16.08 | 32.26 | 19.61 | 15.86 | 22.16 | 15.61 | 16.32 |
| 2 kHz | 7.27 | 11.93 | 20.24 | 10.47 | 14.17 | 6.15 | 7.60 |
| 4 kHz | 0.78 | 2.03 | 5.29 | 0.40 | 2.49 | 0.08 | 0.00 |
| 8 kHz | 0.78 | 0.77 | 1.23 | 3.24 | 1.59 | 0.00 | 0.00 |
| 16 kHz | 0.84 | 2.33 | 2.67 | 4.34 | 3.09 | 0.00 | 0.00 |

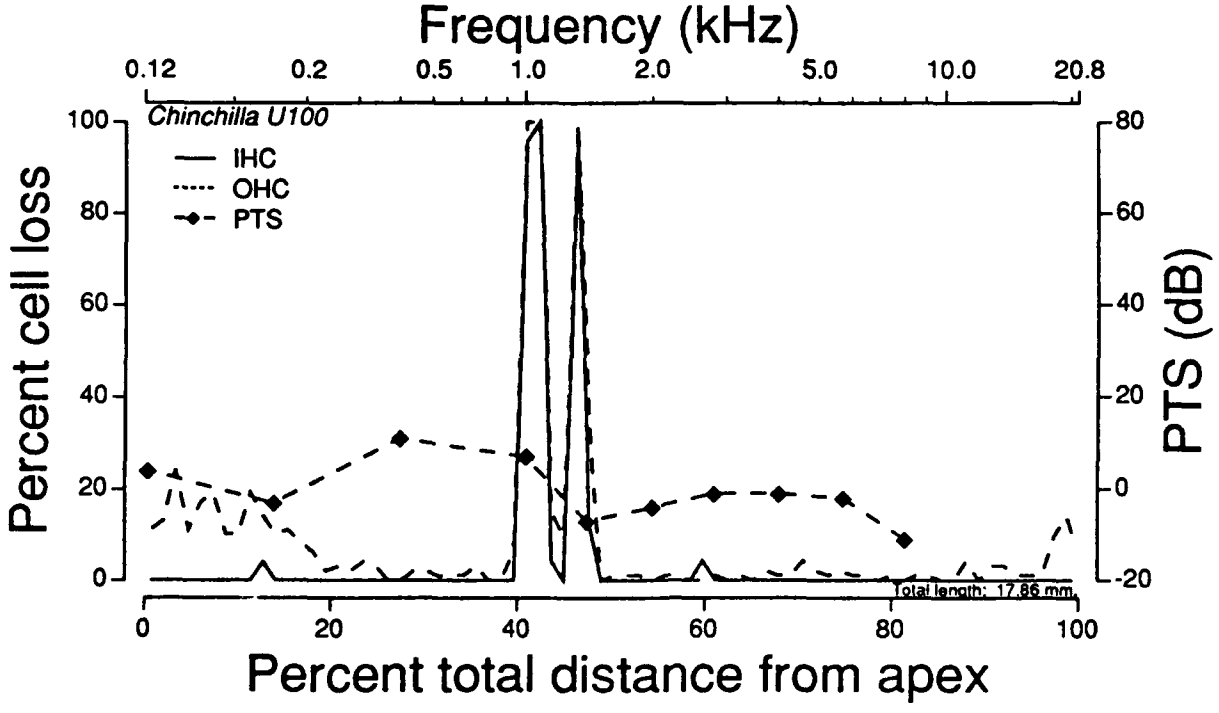

Frequency (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
Chinchilla S70
IHC
OHC
PTS
Percent cell loss
PTS (dB)
Total length: 19.20 mm
Percent total distance from apex


Frequency (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
Chinchilla T71
IHC
OHC
PTS
Percent cell loss
PTS (dB)
Total length: 17.57 mm
Percent total distance from apex


Frequency (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
Chinchilla U86
IHC
OHC
PTS
Percent cell loss
PTS (dB)
Total length: 18.17 mm
0
20
40
60
80
100
-20
Percent total distance from apex


Frequency (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
Chinchilla U87
IHC
OHC
PTS
Percent cell loss
PTS (dB)
Total length: 17.35 mm
0
20
40
60
80
100
-20
Percent total distance from apex


Frequency (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
Chinchilla U91
IHC
OHC
PTS
Percent cell loss
PTS (dB)
Total length: 18.02 mm
0
20
40
60
80
100
-20
Percent total distance from apex


Frequency (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
Chinchilla U100
IHC
OHC
PTS
Percent cell loss
PTS (dB)
Total length: 17.86 mm
0
20
40
60
80
100
-20
Percent total distance from apex

Summary data for the group exposed to

2075 Hz center frequency, 139-dB peak SPL

Animal #

U92 - Completed the entire protocol

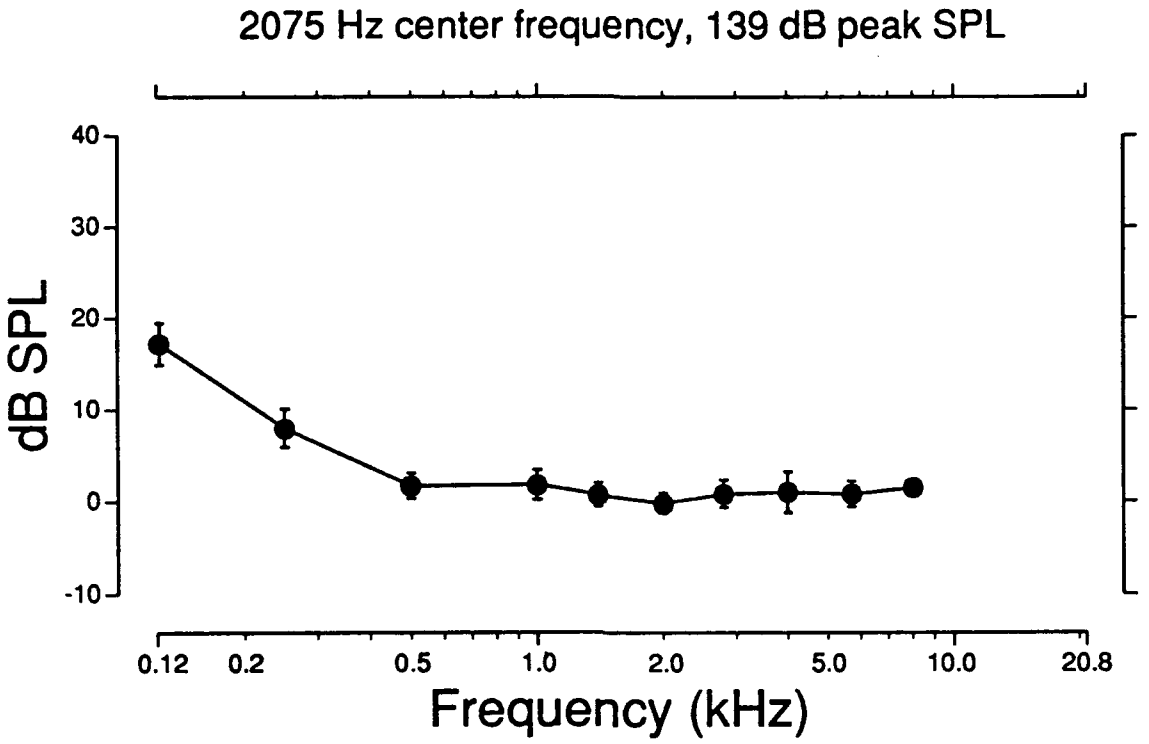
U108 - Completed the entire protocol

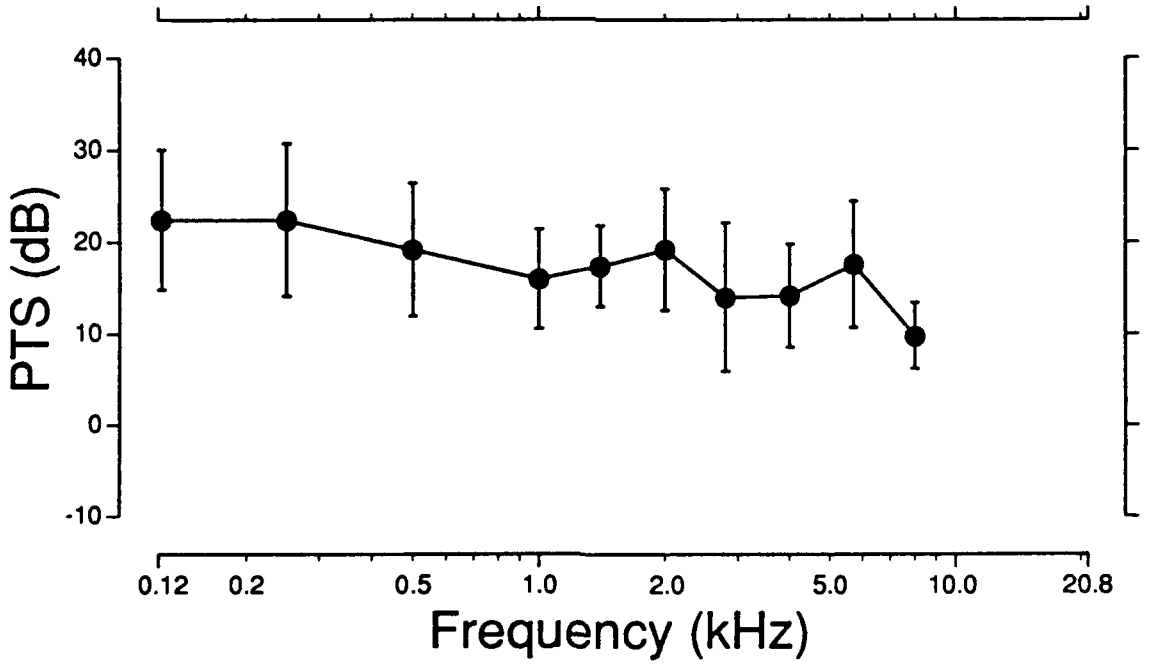
U112 - Completed the entire protocol

U113 - Completed the entire protocol

U178 - Completed the entire protocol

U181 - Completed the entire protocol


2075 Hz center frequency, 139 dB peak SPL
dB SPL
40
30
20
10
0
-10
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
Frequency (kHz)


PTS (dB)
40
30
20
10
0
-10
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
Frequency (kHz)

2075 Hz center frequency, 139 dB Peak SPL

Preexposure thresholds (dB SPL)

| Animal\kHz | .125 | .25 | 0.5 | 1.0 | 1.4 | 2.0 | 2.8 | 4.0 | 5.7 | 8.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| U92 | 18.5 | 4.5 | 0.5 | -1.5 | -0.5 | -1.5 | 1.5 | -2.5 | 1.5 | 3.5 |
| U108 | 23.5 | 11.5 | 1.5 | 7.5 | 5.5 | 3.5 | 0.5 | 10.5 | 6.5 | 2.5 |
| U112 | 19.5 | -0.5 | 3.5 | -0.5 | -2.5 | -4.5 | 7.5 | 1.5 | -3.5 | -1.5 |
| U113 | 6.5 | 12.5 | -0.5 | 5.5 | 3.5 | 1.5 | -1.5 | -1.5 | -1.5 | 1.5 |
| U178 | 17.5 | 8.5 | 7.5 | -1.5 | 0.5 | 0.5 | -2.5 | 2.5 | 0.5 | 2.5 |
| U181 | 17.5 | 11.5 | -2.5 | 1.5 | -2.5 | -0.5 | -0.5 | -4.5 | 1.5 | 0.5 |
| Mean | 17.2 | 8.0 | 1.7 | 1.8 | 0.7 | -0.2 | 0.8 | 1.0 | 0.8 | 1.5 |
| S.D. | 5.7 | 5.1 | 3.5 | 3.8 | 3.3 | 2.7 | 3.6 | 5.3 | 3.4 | 1.8 |

Postexposure thresholds (dB SPL)

| Animal\kHz | .125 | .25 | 0.5 | 1.0 | 1.4 | 2.0 | 2.8 | 4.0 | 5.7 | 8.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| U92 | 24.5 | 16.5 | 14.5 | 8.5 | 17.5 | 22.5 | 13.5 | 12.5 | 6.5 | 9.5 |
| U108 | 75.0 | 70.0 | 49.0 | 47.0 | 41.0 | 47.0 | 49.0 | 42.0 | 51.0 | 28.0 |
| U112 | 47.0 | 11.0 | 27.0 | 9.0 | 7.0 | 15.0 | 16.0 | 23.0 | 20.0 | 5.0 |
| U113 | 14.0 | 30.0 | 7.0 | 16.0 | 16.0 | 7.0 | -2.0 | -4.0 | 10.0 | 5.0 |
| U178 | 37.0 | 24.0 | 11.0 | 11.0 | 11.0 | 4.0 | 1.0 | 6.0 | 6.0 | 9.0 |
| U181 | 42.0 | 21.0 | 17.0 | 23.0 | 16.0 | 20.0 | 31.0 | 19.0 | 19.0 | 19.0 |
| Mean | 39.9 | 28.8 | 20.9 | 19.1 | 18.1 | 19.3 | 18.1 | 16.4 | 18.8 | 12.6 |
| S.D. | 21.0 | 21.2 | 15.3 | 14.7 | 11.9 | 15.4 | 19.2 | 15.8 | 16.9 | 9.1 |

Permanent threshold shift (dB)

| Animal\kHz | .125 | .25 | 0.5 | 1.0 | 1.4 | 2.0 | 2.8 | 4.0 | 5.7 | 8.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| U92 | 6.0 | 9.0 | 14.0 | 8.0 | 19.0 | 24.0 | 10.0 | 17.0 | 3.0 | 7.0 |
| U108 | 51.5 | 58.5 | 47.5 | 39.5 | 35.5 | 43.5 | 48.5 | 31.5 | 44.5 | 25.5 |
| U112 | 27.5 | 11.5 | 23.5 | 9.5 | 9.5 | 19.5 | 8.5 | 21.5 | 23.5 | 6.5 |
| U113 | 7.5 | 17.5 | 7.5 | 10.5 | 12.5 | 5.5 | -0.5 | -2.5 | 11.5 | 3.5 |
| U178 | 19.5 | 15.5 | 3.5 | 12.5 | 10.5 | 3.5 | 3.5 | 3.5 | 5.5 | 6.5 |
| U181 | 24.5 | 9.5 | 19.5 | 21.5 | 18.5 | 20.5 | 31.5 | 23.5 | 17.5 | 18.5 |
| Mean | 22.4 | 22.4 | 19.2 | 16.0 | 17.4 | 19.2 | 14.0 | 14.2 | 17.6 | 9.8 |
| S.D. | 18.5 | 20.5 | 17.5 | 13.2 | 10.8 | 16.2 | 19.7 | 13.7 | 17.0 | 8.9 |

Temporary Threshold Shift (dB): 2075 Hz center frequency, 139 dB Peak SPL

Frequency 0.125 kHz

| Animal\day | 0. | .042 | .125 | .25 | 1. | 2. | 6. | 9. | 13. | 16. | 20. | 23. | 27. | 29. | 30. | Max |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U92 | 2.5 | 47.5 | 22.5 | 37.5 | 27.5 | 22.5 | 22.5 | 17.5 | 22.5 | 37.5 | 27.5 | 22.5 | 17.5 | 22.5 | 32.5 | 47.5 |
| U108 | 27.5 | 57.5 | 22.5 | 32.5 | 57.5 | 77.5 | 67.5 | 82.5 | 42.5 | 27.5 | 57.5 | 62.5 | 27.5 | 42.5 | 67.5 | 82.5 |
| U112 | 42.5 | 42.5 | 42.5 | 47.5 | 47.5 | 22.5 | 22.5 | 27.5 | 27.5 | 17.5 | 17.5 | 37.5 | 22.5 | 27.5 | 32.5 | 47.5 |
| U113 | 32.5 | 37.5 | 32.5 | 27.5 | 12.5 | 22.5 | 27.5 | 17.5 | 22.5 | 32.5 | 7.5 | 12.5 | -7.5 | 12.5 | 12.5 | 37.5 |
| U178 | 32.5 | 42.5 | 42.5 | 42.5 | 27.5 | 32.5 | 47.5 | 17.5 | 17.5 | 37.5 | 22.5 | 12.5 | 22.5 | 27.5 | 12.5 | 47.5 |
| U181 | 47.5 | 67.5 | 27.5 | 42.5 | 27.5 | 22.5 | 17.5 | 37.5 | 32.5 | 32.5 | 22.5 | 32.5 | 27.5 | 2.5 | 37.5 | 67.5 |
| Mean | 30.8 | 49.2 | 31.7 | 38.3 | 33.3 | 33.3 | 34.2 | 33.3 | 27.5 | 30.8 | 25.8 | 30.0 | 18.3 | 22.5 | 32.5 | 55.0 |
| S.D. | 15.7 | 11.3 | 9.2 | 7.4 | 16.3 | 22.0 | 19.4 | 25.4 | 8.9 | 7.5 | 16.9 | 18.9 | 13.2 | 13.8 | 20.2 | 16.7 |

Frequency 0.250 kHz

| Animal\day | 0. | .042 | .125 | .25 | 1. | 2. | 6. | 9. | 13. | 16. | 20. | 23. | 27. | 29. | 30. | Max |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U92 | 57.5 | 27.5 | 22.5 | 32.5 | 27.5 | 7.5 | 12.5 | 22.5 | 12.5 | 12.5 | 12.5 | 12.5 | 32.5 | 12.5 | 12.5 | 57.5 |
| U108 | 62.5 | 32.5 | 57.5 | 62.5 | 67.5 | 57.5 | 52.5 | 62.5 | 7.5 | 32.5 | 57.5 | 62.5 | 47.5 | 67.5 | 57.5 | 67.5 |
| U112 | 47.5 | 47.5 | 37.5 | 42.5 | 47.5 | 17.5 | 32.5 | 42.5 | 12.5 | 12.5 | 12.5 | 7.5 | 7.5 | 17.5 | 12.5 | 47.5 |
| U113 | 32.5 | 27.5 | 22.5 | 37.5 | 22.5 | 12.5 | 12.5 | 22.5 | 7.5 | 17.5 | 57.5 | 2.5 | 7.5 | 2.5 | 17.5 | 57.5 |
| U178 | 52.5 | 32.5 | 27.5 | 32.5 | 32.5 | 12.5 | 22.5 | 27.5 | 12.5 | 12.5 | 22.5 | 22.5 | 12.5 | 12.5 | 7.5 | 52.5 |
| U181 | 37.5 | 67.5 | 27.5 | 32.5 | 47.5 | 37.5 | 2.5 | 22.5 | 12.5 | 17.5 | 12.5 | 7.5 | 2.5 | 12.5 | 12.5 | 67.5 |
| Mean | 48.3 | 39.2 | 32.5 | 40.0 | 40.8 | 24.2 | 22.5 | 33.3 | 10.8 | 17.5 | 29.2 | 19.2 | 18.3 | 20.8 | 20.0 | 58.3 |
| S.D. | 11.6 | 15.7 | 13.4 | 11.7 | 16.6 | 19.4 | 17.9 | 16.3 | 2.6 | 7.7 | 22.3 | 22.3 | 17.7 | 23.4 | 18.6 | 8.0 |

Frequency 0.500 kHz

| Animal\day | 0. | .042 | .125 | .25 | 1. | 2. | 6. | 9. | 13. | 16. | 20. | 23. | 27. | 29. | 30. | Max |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U92 | 27.5 | 52.5 | 37.5 | 27.5 | 17.5 | 22.5 | 12.5 | 7.5 | 7.5 | 17.5 | 7.5 | 12.5 | 7.5 | 32.5 | 12.5 | 52.5 |
| U108 | 52.5 | 62.5 | 67.5 | 57.5 | 62.5 | 52.5 | 57.5 | 62.5 | 12.5 | 32.5 | 57.5 | 47.5 | 42.5 | 32.5 | 57.5 | 67.5 |
| U112 | 7.5 | 42.5 | 32.5 | 37.5 | 42.5 | 2.5 | 17.5 | 7.5 | 17.5 | 12.5 | 12.5 | 17.5 | 27.5 | 42.5 | 17.5 | 42.5 |
| U113 | 17.5 | 12.5 | 17.5 | 12.5 | 12.5 | 7.5 | -7.5 | 2.5 | 12.5 | 17.5 | 47.5 | 2.5 | -12.5 | -7.5 | 7.5 | 47.5 |
| U178 | 27.5 | 22.5 | 32.5 | 27.5 | 12.5 | 27.5 | 22.5 | 12.5 | 2.5 | 2.5 | 12.5 | -7.5 | 2.5 | 2.5 | 7.5 | 32.5 |
| U181 | 62.5 | 52.5 | 42.5 | 57.5 | 57.5 | 52.5 | 27.5 | 37.5 | 32.5 | 17.5 | 17.5 | 22.5 | 7.5 | 37.5 | 12.5 | 62.5 |
| Mean | 32.5 | 40.8 | 38.3 | 36.7 | 34.2 | 27.5 | 21.7 | 21.7 | 14.2 | 16.7 | 25.8 | 15.8 | 12.5 | 23.3 | 19.2 | 50.8 |
| S.D. | 21.0 | 19.4 | 16.6 | 18.0 | 22.9 | 21.4 | 21.3 | 23.5 | 10.3 | 9.7 | 21.1 | 18.9 | 19.5 | 20.6 | 19.1 | 12.9 |

Temporary Threshold Shift (dB): 2075 Hz center frequency, 139 dB Peak SPL

Frequency 1.000 kHz

| Animal\day | 0. | .042 | .125 | .25 | 1. | 2. | 6. | 9. | 13. | 16. | 20. | 23. | 27. | 29. | 30. | Max |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U92 | 47.5 | 57.5 | 52.5 | 47.5 | 37.5 | 22.5 | 12.5 | 17.5 | 7.5 | 17.5 | 12.5 | 7.5 | 2.5 | 2.5 | 17.5 | 57.5 |
| U108 | 52.5 | 47.5 | 62.5 | 62.5 | 57.5 | 57.5 | 2.5 | 42.5 | 12.5 | 42.5 | 37.5 | 42.5 | 42.5 | 32.5 | 42.5 | 62.5 |
| U112 | 27.5 | 37.5 | 12.5 | 42.5 | 52.5 | 12.5 | 7.5 | 7.5 | 12.5 | 12.5 | -7.5 | 12.5 | 12.5 | 27.5 | 2.5 | 52.5 |
| U113 | 27.5 | 7.5 | 12.5 | 17.5 | 17.5 | 17.5 | 7.5 | 12.5 | -2.5 | 7.5 | 37.5 | 2.5 | -12.5 | 12.5 | 12.5 | 37.5 |
| U178 | 52.5 | 52.5 | 52.5 | 32.5 | 22.5 | 27.5 | 22.5 | 2.5 | 12.5 | 17.5 | 22.5 | 12.5 | 12.5 | -2.5 | 17.5 | 52.5 |
| U181 | 77.5 | 47.5 | 32.5 | 57.5 | 32.5 | 22.5 | 47.5 | 22.5 | 7.5 | 2.5 | 7.5 | 37.5 | 7.5 | 32.5 | 22.5 | 77.5 |
| Mean | 47.5 | 41.7 | 37.5 | 43.3 | 36.7 | 26.7 | 16.7 | 17.5 | 8.3 | 16.7 | 18.3 | 19.2 | 10.8 | 17.5 | 19.2 | 56.7 |
| S.D. | 18.7 | 18.0 | 21.7 | 16.6 | 15.9 | 15.9 | 16.6 | 14.1 | 5.8 | 13.9 | 17.7 | 16.6 | 18.1 | 15.5 | 13.3 | 13.2 |

Frequency 1.400 kHz

| Animal\day | 0. | .042 | .125 | .25 | 1. | 2. | 6. | 9. | 13. | 16. | 20. | 23. | 27. | 29. | 30. | Max |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U92 | 52.5 | 62.5 | 52.5 | 42.5 | 27.5 | 37.5 | 12.5 | 37.5 | 32.5 | 32.5 | 12.5 | 12.5 | 22.5 | 12.5 | 27.5 | 62.5 |
| U108 | 27.5 | 52.5 | 42.5 | 57.5 | 52.5 | 42.5 | 42.5 | 42.5 | 32.5 | 27.5 | 47.5 | 27.5 | 37.5 | 32.5 | 32.5 | 57.5 |
| U112 | 32.5 | 37.5 | 22.5 | 42.5 | 47.5 | 27.5 | 12.5 | 2.5 | 2.5 | 62.5 | -7.5 | 7.5 | 12.5 | 12.5 | 22.5 | 62.5 |
| U113 | 22.5 | 12.5 | 12.5 | 12.5 | 22.5 | 12.5 | 2.5 | 2.5 | 2.5 | 7.5 | 17.5 | 27.5 | 2.5 | 7.5 | 7.5 | 27.5 |
| U178 | 52.5 | 57.5 | 52.5 | 52.5 | 37.5 | 37.5 | 52.5 | 17.5 | 27.5 | 17.5 | 2.5 | 17.5 | 12.5 | 2.5 | 17.5 | 57.5 |
| U181 | 52.5 | 57.5 | 47.5 | 52.5 | 12.5 | 32.5 | 62.5 | 37.5 | 2.5 | 7.5 | 27.5 | -2.5 | 7.5 | 12.5 | 47.5 | 62.5 |
| Mean | 40.0 | 46.7 | 38.3 | 43.3 | 33.3 | 31.7 | 30.8 | 23.3 | 16.7 | 25.8 | 16.7 | 15.0 | 15.8 | 13.3 | 25.8 | 55.0 |
| S.D. | 14.1 | 18.8 | 16.9 | 16.3 | 15.3 | 10.7 | 24.8 | 18.3 | 15.6 | 20.7 | 19.3 | 11.7 | 12.5 | 10.2 | 13.7 | 13.7 |

Frequency 2.000 kHz

| Animal\day | 0. | .042 | .125 | .25 | 1. | 2. | 6. | 9. | 13. | 16. | 20. | 23. | 27. | 29. | 30. | Max |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U92 | 27.5 | 52.5 | 47.5 | 47.5 | 42.5 | 42.5 | 22.5 | 37.5 | 22.5 | 32.5 | 2.5 | 22.5 | 27.5 | 27.5 | 32.5 | 52.5 |
| U108 | 27.5 | 52.5 | 47.5 | 47.5 | 52.5 | 37.5 | 72.5 | 57.5 | 12.5 | 32.5 | 57.5 | 57.5 | 22.5 | 22.5 | 57.5 | 72.5 |
| U112 | 32.5 | 32.5 | 37.5 | 42.5 | 32.5 | 12.5 | 7.5 | 32.5 | 2.5 | 2.5 | 7.5 | 12.5 | 2.5 | 47.5 | 27.5 | 47.5 |
| U113 | 12.5 | 7.5 | 7.5 | 12.5 | 7.5 | 2.5 | 7.5 | -2.5 | 2.5 | -2.5 | 7.5 | 2.5 | 2.5 | 2.5 | 12.5 | 12.5 |
| U178 | 47.5 | 67.5 | 62.5 | 57.5 | 32.5 | 42.5 | 32.5 | 17.5 | 17.5 | 2.5 | -2.5 | 12.5 | -2.5 | 2.5 | 7.5 | 67.5 |
| U181 | 52.5 | 57.5 | 62.5 | 62.5 | 57.5 | 32.5 | 37.5 | 22.5 | 7.5 | 32.5 | 17.5 | 2.5 | 12.5 | 42.5 | 27.5 | 62.5 |
| Mean | 33.3 | 45.0 | 44.2 | 45.0 | 37.5 | 28.3 | 30.0 | 27.5 | 10.8 | 16.7 | 15.0 | 18.3 | 10.8 | 24.2 | 27.5 | 52.5 |
| S.D. | 14.6 | 21.6 | 20.4 | 17.5 | 17.9 | 16.9 | 24.2 | 20.2 | 8.2 | 17.4 | 21.9 | 20.6 | 12.1 | 19.1 | 17.6 | 21.7 |

Temporary Threshold Shift (dB): 2075 Hz center frequency, 139 dB Peak SPL

Frequency 2.800 kHz

| Animal\day | 0. | .042 | .125 | .25 | 1. | 2. | 6. | 9. | 13. | 16. | 20. | 23. | 27. | 29. | 30. | Max |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U92 | 27.5 | 32.5 | 32.5 | 52.5 | 42.5 | 32.5 | 32.5 | 17.5 | 17.5 | 27.5 | 12.5 | 12.5 | 12.5 | 17.5 | 12.5 | 52.5 |
| U108 | 42.5 | 42.5 | 57.5 | 72.5 | 57.5 | 52.5 | 82.5 | 32.5 | 17.5 | 17.5 | 57.5 | 62.5 | 17.5 | 57.5 | 47.5 | 82.5 |
| U112 | 32.5 | 32.5 | 32.5 | 32.5 | 42.5 | 17.5 | 12.5 | 12.5 | 2.5 | 2.5 | -7.5 | 17.5 | 2.5 | 22.5 | 7.5 | 42.5 |
| U113 | 12.5 | 32.5 | 12.5 | 27.5 | 17.5 | 2.5 | 7.5 | 12.5 | 2.5 | -7.5 | -2.5 | 12.5 | -12.5 | -2.5 | 2.5 | 32.5 |
| U178 | 57.5 | 57.5 | 52.5 | 62.5 | 52.5 | 32.5 | 37.5 | 17.5 | 12.5 | 12.5 | 12.5 | -2.5 | 2.5 | 2.5 | 2.5 | 62.5 |
| U181 | 42.5 | 62.5 | 27.5 | 47.5 | 32.5 | 22.5 | 12.5 | 37.5 | -2.5 | 7.5 | 17.5 | 37.5 | 37.5 | 22.5 | 42.5 | 62.5 |
| Mean | 35.8 | 43.3 | 35.8 | 49.2 | 40.8 | 26.7 | 30.8 | 21.7 | 8.3 | 10.0 | 15.0 | 23.3 | 10.0 | 20.0 | 19.2 | 55.8 |
| S.D. | 15.4 | 13.6 | 16.6 | 17.2 | 14.4 | 16.9 | 28.0 | 10.7 | 8.6 | 12.1 | 23.0 | 23.1 | 17.0 | 21.2 | 20.4 | 17.5 |

Frequency 4.000 kHz

| Animal\day | 0. | .042 | .125 | .25 | 1. | 2. | 6. | 9. | 13. | 16. | 20. | 23. | 27. | 29. | 30. | Max |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U92 | 17.5 | 32.5 | 42.5 | 27.5 | 12.5 | 7.5 | 12.5 | 12.5 | 7.5 | 2.5 | 7.5 | 12.5 | 12.5 | 2.5 | 27.5 | 42.5 |
| U108 | 32.5 | 37.5 | 47.5 | 47.5 | 32.5 | 57.5 | 57.5 | 27.5 | 22.5 | 22.5 | 32.5 | 32.5 | 27.5 | 57.5 | 7.5 | 57.5 |
| U112 | 12.5 | 32.5 | 32.5 | 32.5 | 27.5 | 2.5 | 7.5 | 12.5 | 7.5 | 2.5 | 7.5 | 12.5 | 2.5 | 17.5 | 67.5 | 67.5 |
| U113 | 12.5 | 32.5 | 37.5 | 7.5 | 22.5 | 2.5 | 7.5 | 2.5 | 2.5 | 7.5 | -7.5 | 2.5 | -7.5 | -2.5 | 2.5 | 37.5 |
| U178 | 17.5 | 32.5 | 32.5 | 37.5 | 52.5 | 22.5 | 32.5 | 7.5 | 7.5 | 2.5 | -2.5 | -2.5 | 2.5 | 12.5 | 7.5 | 52.5 |
| U181 | 37.5 | 32.5 | 17.5 | 42.5 | 17.5 | 47.5 | 22.5 | 17.5 | 52.5 | 22.5 | 42.5 | 12.5 | 12.5 | 22.5 | 27.5 | 52.5 |
| Mean | 21.7 | 33.3 | 35.0 | 32.5 | 27.5 | 23.3 | 23.3 | 13.3 | 16.7 | 10.0 | 13.3 | 11.7 | 8.3 | 18.3 | 23.3 | 51.7 |
| S.D. | 10.7 | 2.0 | 10.4 | 14.1 | 14.1 | 24.0 | 19.3 | 8.6 | 18.8 | 9.9 | 19.9 | 12.0 | 12.0 | 21.3 | 24.2 | 10.7 |

Frequency 5.700 kHz

| Animal\day | 0. | .042 | .125 | .25 | 1. | 2. | 6. | 9. | 13. | 16. | 20. | 23. | 27. | 29. | 30. | Max |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U92 | 12.5 | 32.5 | 12.5 | 22.5 | 12.5 | 12.5 | 17.5 | 2.5 | 7.5 | 2.5 | 7.5 | 2.5 | 2.5 | 12.5 | 7.5 | 32.5 |
| U108 | 12.5 | 42.5 | 42.5 | 42.5 | 27.5 | 12.5 | 7.5 | 17.5 | 12.5 | 12.5 | 42.5 | 42.5 | 42.5 | 67.5 | 27.5 | 67.5 |
| U112 | 12.5 | 22.5 | 2.5 | 12.5 | 12.5 | 2.5 | 2.5 | 2.5 | 17.5 | 12.5 | 12.5 | 12.5 | 47.5 | 22.5 | 22.5 | 47.5 |
| U113 | 22.5 | 42.5 | 32.5 | 12.5 | 7.5 | 2.5 | -2.5 | 12.5 | 12.5 | 2.5 | 17.5 | 27.5 | 12.5 | 2.5 | -2.5 | 42.5 |
| U178 | 57.5 | 42.5 | 42.5 | 32.5 | 22.5 | 12.5 | 22.5 | 2.5 | 2.5 | 7.5 | 2.5 | 2.5 | 7.5 | 7.5 | 7.5 | 57.5 |
| U181 | 12.5 | 22.5 | 47.5 | 57.5 | 47.5 | 7.5 | 22.5 | 22.5 | 47.5 | 2.5 | 2.5 | 12.5 | 32.5 | 12.5 | 27.5 | 57.5 |
| Mean | 21.7 | 34.2 | 30.0 | 30.0 | 21.7 | 8.3 | 11.7 | 10.0 | 16.7 | 6.7 | 14.2 | 16.7 | 24.2 | 20.8 | 15.0 | 50.8 |
| S.D. | 18.0 | 9.8 | 18.4 | 17.8 | 14.6 | 4.9 | 10.7 | 8.8 | 15.9 | 4.9 | 15.1 | 15.6 | 19.1 | 23.8 | 12.5 | 12.5 |

Temporary Threshold Shift (dB): 2075 Hz center frequency, 139 dB Peak SPL

Frequency 8.000 kHz

| Animal\da, | 0. | .042 | .125 | .25 | 1. | 2. | 6. | 9. | 13. | 16. | 20. | 23. | 27. | 29. | 30. | Max |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U92 | 27.5 | 32.5 | 17.5 | 27.5 | 7.5 | 27.5 | 12.5 | 12.5 | 47.5 | 7.5 | 7.5 | 2.5 | 22.5 | 2.5 | 12.5 | 47.5 |
| U108 | 22.5 | 72.5 | 32.5 | 42.5 | 32.5 | 22.5 | 7.5 | 62.5 | 67.5 | 27.5 | 37.5 | 32.5 | 12.5 | 12.5 | 32.5 | 72.5 |
| U112 | 22.5 | 12.5 | 22.5 | 27.5 | 12.5 | 2.5 | 12.5 | 2.5 | 27.5 | 2.5 | 12.5 | 7.5 | 2.5 | 7.5 | 2.5 | 27.5 |
| U113 | 7.5 | 57.5 | 37.5 | 7.5 | 7.5 | -2.5 | 12.5 | -7.5 | 2.5 | 12.5 | 2.5 | 2.5 | 2.5 | -2.5 | 12.5 | 57.5 |
| U178 | 17.5 | 22.5 | 42.5 | 47.5 | 12.5 | 32.5 | 52.5 | 17.5 | -2.5 | -2.5 | 12.5 | 7.5 | 12.5 | -2.5 | 2.5 | 52.5 |
| U181 | 12.5 | 57.5 | 17.5 | 47.5 | 62.5 | 32.5 | -7.5 | 32.5 | 7.5 | 7.5 | 57.5 | -2.5 | 2.5 | 22.5 | 12.5 | 62.5 |
| Mean | 18.3 | 42.5 | 28.3 | 33.3 | 22.5 | 19.2 | 15.0 | 20.0 | 25.0 | 9.2 | 21.7 | 8.3 | 9.2 | 6.7 | 12.5 | 53.3 |
| S.D. | 7.4 | 23.5 | 10.7 | 15.6 | 21.7 | 15.4 | 19.9 | 24.8 | 27.9 | 10.3 | 21.3 | 12.4 | 8.2 | 9.7 | 11.0 | 15.3 |

Summary of group anatomical data

with cochleograms and PTS audiograms

for individual animals

2075 Hz center frequency, 139 dB peak SPL

Total number of cochlear sensory cells missing

| Animal number | Inner hair cells | 1st row outer hair cells | 2nd row outer hair cells | 3rd row outer hair cells | Total outer hair cells |
|---|---|---|---|---|---|
| U92 | 13 | 548 | 495 | 523 | 1566 |
| U108 | 237 | 618 | 633 | 650 | 1901 |
| U112 | 39 | 132 | 160 | 162 | 454 |
| U113 | 6 | 37 | 25 | 52 | 114 |
| U178 | 41 | 355 | 349 | 339 | 1043 |
| U181 | 217 | 935 | 944 | 885 | 2764 |
| Group mean | 92 | | | | 1307 |
| S.D. | 106 | | | | 976 |
| S.E. | 43 | | | | 398 |

Total sensory cell losses over octave band lengths of the cochlea centered at the frequencies indicated

| | Octave band center frequency | Inner hair cells | Outer hair cells |
|---|---|---|---|
| Group means | | | |
| | 0.125 kHz | 1.3 | 59.3 |
| | 0.25 kHz | 1.5 | 41.3 |
| | 0.5 kHz | 0.7 | 47.8 |
| | 1 kHz | 31.2 | 345.3 |
| | 2 kHz | 51.3 | 552.3 |
| | 4 kHz | 1.5 | 222.3 |
| | 8 kHz | 4.3 | 32.7 |
| | 16 kHz | 0.3 | 5.8 |
| Standard deviations | | | |
| | 0.125 kHz | 1.0 | 31.9 |
| | 0.25 kHz | 1.0 | 19.1 |
| | 0.5 kHz | 1.2 | 25.0 |
| | 1 kHz | 49.2 | 341.3 |
| | 2 kHz | 57.1 | 394.9 |
| | 4 kHz | 1.4 | 350.0 |
| | 8 kHz | 9.7 | 44.7 |
| | 16 kHz | 0.5 | 4.6 |

2075 Hz center frequency, 139 dB peak SPL

Total sensory cell losses over octave band frequencies

| | Inner hair cells | 1st row outer hair cells | 2nd row outer hair cells | 3rd row outer hair cells | Comb. outer hair cells | Inner pillar cells | Outer pillar cells |
|---|---|---|---|---|---|---|---|
| **Chinchilla U92** | | | | | | | |
| 0.125 kHz | 1 | 9 | 17 | 67 | 93 | 0 | 2 |
| 0.25 kHz | 1 | 19 | 7 | 45 | 71 | 0 | 0 |
| 0.5 kHz | 1 | 31 | 5 | 14 | 50 | 0 | 0 |
| 1 kHz | 2 | 59 | 48 | 37 | 144 | 0 | 0 |
| 2 kHz | 2 | 325 | 323 | 262 | 910 | 0 | 9 |
| 4 kHz | 3 | 81 | 72 | 69 | 222 | 1 | 5 |
| 8 kHz | 2 | 20 | 19 | 23 | 62 | 1 | 4 |
| 16 kHz | 1 | 4 | 4 | 6 | 14 | 0 | 0 |
| TOTALS | 13 | 548 | 495 | 523 | 1566 | 2 | 20 |
| **Chinchilla U108** | | | | | | | |
| 0.125 kHz | 1 | 2 | 15 | 35 | 52 | 0 | 1 |
| 0.25 kHz | 2 | 4 | 12 | 9 | 25 | 0 | 0 |
| 0.5 kHz | 0 | 16 | 35 | 27 | 78 | 0 | 2 |
| 1 kHz | 121 | 275 | 263 | 254 | 792 | 264 | 175 |
| 2 kHz | 112 | 299 | 292 | 308 | 899 | 247 | 180 |
| 4 kHz | 1 | 15 | 11 | 15 | 41 | 0 | 0 |
| 8 kHz | 0 | 7 | 4 | 2 | 13 | 0 | 0 |
| 16 kHz | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| TOTALS | 237 | 618 | 633 | 650 | 1901 | 511 | 358 |
| **Chinchilla U112** | | | | | | | |
| 0.125 kHz | 2 | 6 | 8 | 20 | 34 | 0 | 2 |
| 0.25 kHz | 1 | 5 | 4 | 24 | 33 | 0 | 0 |
| 0.5 kHz | 3 | 8 | 14 | 13 | 35 | 0 | 0 |
| 1 kHz | 3 | 15 | 23 | 14 | 52 | 12 | 7 |
| 2 kHz | 29 | 51 | 57 | 45 | 153 | 71 | 40 |
| 4 kHz | 0 | 43 | 51 | 43 | 137 | 0 | 0 |
| 8 kHz | 0 | 2 | 2 | 2 | 6 | 0 | 0 |
| 16 kHz | 1 | 2 | 1 | 1 | 4 | 0 | 0 |
| TOTALS | 39 | 132 | 160 | 162 | 454 | 83 | 49 |

2075 Hz center frequency, 139 dB peak SPL

Total sensory cell losses over octave band frequencies

| | Inner hair cells | 1st row outer hair cells | 2nd row outer hair cells | 3rd row outer hair cells | Comb. outer hair cells | Inner pillar cells | Outer pillar cells |
|---|---|---|---|---|---|---|---|
| **Chinchilla U113** | | | | | | | |
| 0.125 kHz | 3 | 6 | 5 | 18 | 29 | 0 | 0 |
| 0.25 kHz | 2 | 11 | 0 | 9 | 20 | 0 | 0 |
| 0.5 kHz | 0 | 6 | 6 | 9 | 21 | 0 | 1 |
| 1 kHz | 1 | 8 | 7 | 5 | 20 | 0 | 1 |
| 2 kHz | 0 | 1 | 4 | 5 | 10 | 0 | 0 |
| 4 kHz | 0 | 0 | 2 | 5 | 7 | 0 | 0 |
| 8 kHz | 0 | 2 | 0 | 1 | 3 | 0 | 0 |
| 16 kHz | 0 | 3 | 1 | 0 | 4 | 0 | 0 |
| TOTALS | 6 | 37 | 25 | 52 | 114 | 0 | 2 |
| **Chinchilla U178** | | | | | | | |
| 0.125 kHz | 1 | 9 | 25 | 71 | 105 | 0 | 1 |
| 0.25 kHz | 3 | 1 | 4 | 47 | 52 | 0 | 0 |
| 0.5 kHz | 0 | 6 | 2 | 18 | 26 | 0 | 1 |
| 1 kHz | 3 | 150 | 129 | 52 | 331 | 3 | 4 |
| 2 kHz | 32 | 182 | 185 | 146 | 513 | 73 | 47 |
| 4 kHz | 2 | 3 | 4 | 4 | 11 | 0 | 0 |
| 8 kHz | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 16 kHz | 0 | 4 | 0 | 0 | 4 | 0 | 0 |
| TOTALS | 41 | 355 | 349 | 339 | 1043 | 76 | 53 |
| **Chinchilla U181** | | | | | | | |
| 0.125 kHz | 0 | 4 | 12 | 27 | 43 | 0 | 2 |
| 0.25 kHz | 0 | 3 | 3 | 41 | 47 | 0 | 1 |
| 0.5 kHz | 0 | 10 | 8 | 59 | 77 | 0 | 0 |
| 1 kHz | 57 | 272 | 265 | 196 | 733 | 170 | 97 |
| 2 kHz | 133 | 283 | 281 | 265 | 829 | 303 | 174 |
| 4 kHz | 3 | 310 | 327 | 279 | 916 | 1 | 0 |
| 8 kHz | 24 | 47 | 47 | 17 | 111 | 0 | 0 |
| 16 kHz | 0 | 6 | 1 | 1 | 8 | 0 | 0 |
| TOTALS | 217 | 935 | 944 | 885 | 2764 | 474 | 274 |

2075 Hz center frequency, 139 dB peak SPL

Total sensory cell losses over octave band frequencies

| | Inner hair cells | 1st row outer hair cells | 2nd row outer hair cells | 3rd row outer hair cells | Comb. outer hair cells | Inner pillar cells | Outer pillar cells |
|---|---|---|---|---|---|---|---|
| **Group means** | | | | | | | |
| 0.125 kHz | 1.3 | 6.0 | 13.7 | 39.7 | 59.3 | 0.0 | 1.3 |
| 0.25 kHz | 1.5 | 7.2 | 5.0 | 29.2 | 41.3 | 0.0 | 0.2 |
| 0.5 kHz | 0.7 | 12.8 | 11.7 | 23.3 | 47.8 | 0.0 | 0.7 |
| 1 kHz | 31.2 | 129.8 | 122.5 | 93.0 | 345.3 | 74.8 | 47.3 |
| 2 kHz | 51.3 | 190.2 | 190.3 | 171.8 | 552.3 | 115.7 | 75.0 |
| 4 kHz | 1.5 | 75.3 | 77.8 | 69.2 | 222.3 | 0.3 | 0.8 |
| 8 kHz | 4.3 | 13.0 | 12.0 | 7.7 | 32.7 | 0.2 | 0.7 |
| 16 kHz | 0.3 | 3.2 | 1.3 | 1.3 | 5.8 | 0.0 | 0.0 |
| TOTALS | 92.2 | 437.5 | 434.3 | 435.2 | 1307.0 | 191.0 | 126.0 |
| **Group standard deviations** | | | | | | | |
| 0.125 kHz | 1.0 | 2.8 | 7.1 | 23.5 | 31.9 | 0.0 | 0.8 |
| 0.25 kHz | 1.0 | 6.7 | 4.1 | 17.6 | 19.1 | 0.0 | 0.4 |
| 0.5 kHz | 1.2 | 9.6 | 12.1 | 18.5 | 25.0 | 0.0 | 0.8 |
| 1 kHz | 49.2 | 122.3 | 117.4 | 105.2 | 341.3 | 114.1 | 73.0 |
| 2 kHz | 57.1 | 137.0 | 133.2 | 126.4 | 394.9 | 128.8 | 81.0 |
| 4 kHz | 1.4 | 118.9 | 125.3 | 105.8 | 350.0 | 0.5 | 2.0 |
| 8 kHz | 9.7 | 18.2 | 18.6 | 9.8 | 44.7 | 0.4 | 1.6 |
| 16 kHz | 0.5 | 2.0 | 1.4 | 2.3 | 4.6 | 0.0 | 0.0 |
| TOTALS | 105.5 | 332.5 | 332.6 | 312.1 | 976.0 | 236.5 | 150.7 |

2075 Hz center frequency, 139 dB peak SPL

Percent sensory cell losses over octave band frequencies

| | Inner hair cells | 1st row outer hair cells | 2nd row outer hair cells | 3rd row outer hair cells | Comb. outer hair cells | Inner pillar cells | Outer pillar cells |
|---|---|---|---|---|---|---|---|
| **Chinchilla U92** | | | | | | | |
| 0.125 kHz | 0.7 | 4.7 | 8.9 | 34.9 | 16.2 | 0.0 | 1.0 |
| 0.25 kHz | 0.4 | 5.7 | 2.1 | 13.4 | 7.1 | 0.0 | 0.0 |
| 0.5 kHz | 0.4 | 9.2 | 1.5 | 4.2 | 5.0 | 0.0 | 0.0 |
| 1 kHz | 0.8 | 18.4 | 15.0 | 11.6 | 15.0 | 0.0 | 0.0 |
| 2 kHz | 0.8 | 99.4 | 98.8 | 80.1 | 92.8 | 0.0 | 2.8 |
| 4 kHz | 1.2 | 24.8 | 22.1 | 21.2 | 22.7 | 0.2 | 1.5 |
| 8 kHz | 0.8 | 6.1 | 5.8 | 7.0 | 6.3 | 0.2 | 1.2 |
| 16 kHz | 0.4 | 1.4 | 1.4 | 2.1 | 1.6 | 0.0 | 0.0 |
| **Chinchilla U108** | | | | | | | |
| 0.125 kHz | 0.7 | 1.1 | 7.9 | 18.5 | 9.2 | 0.0 | 0.5 |
| 0.25 kHz | 0.8 | 1.2 | 3.6 | 2.7 | 2.5 | 0.0 | 0.0 |
| 0.5 kHz | 0.0 | 4.8 | 10.6 | 8.2 | 7.9 | 0.0 | 0.6 |
| 1 kHz | 49.6 | 87.3 | 83.5 | 80.6 | 83.8 | 51.9 | 55.6 |
| 2 kHz | 46.5 | 92.6 | 90.4 | 95.4 | 92.8 | 47.5 | 55.7 |
| 4 kHz | 0.4 | 4.7 | 3.4 | 4.7 | 4.3 | 0.0 | 0.0 |
| 8 kHz | 0.0 | 2.2 | 1.2 | 0.6 | 1.3 | 0.0 | 0.0 |
| 16 kHz | 0.0 | 0.0 | 0.3 | 0.0 | 0.1 | 0.0 | 0.0 |
| **Chinchilla U112** | | | | | | | |
| 0.125 kHz | 1.4 | 3.1 | 4.2 | 10.5 | 5.9 | 0.0 | 1.0 |
| 0.25 kHz | 0.4 | 1.5 | 1.2 | 7.2 | 3.3 | 0.0 | 0.0 |
| 0.5 kHz | 1.2 | 2.4 | 4.2 | 3.9 | 3.5 | 0.0 | 0.0 |
| 1 kHz | 1.2 | 4.7 | 7.2 | 4.4 | 5.4 | 2.3 | 2.2 |
| 2 kHz | 12.0 | 15.6 | 17.5 | 13.8 | 15.6 | 13.5 | 12.3 |
| 4 kHz | 0.0 | 13.2 | 15.7 | 13.2 | 14.0 | 0.0 | 0.0 |
| 8 kHz | 0.0 | 0.6 | 0.6 | 0.6 | 0.6 | 0.0 | 0.0 |
| 16 kHz | 0.4 | 0.7 | 0.3 | 0.3 | 0.4 | 0.0 | 0.0 |

2075 Hz center frequency, 139 dB peak SPL

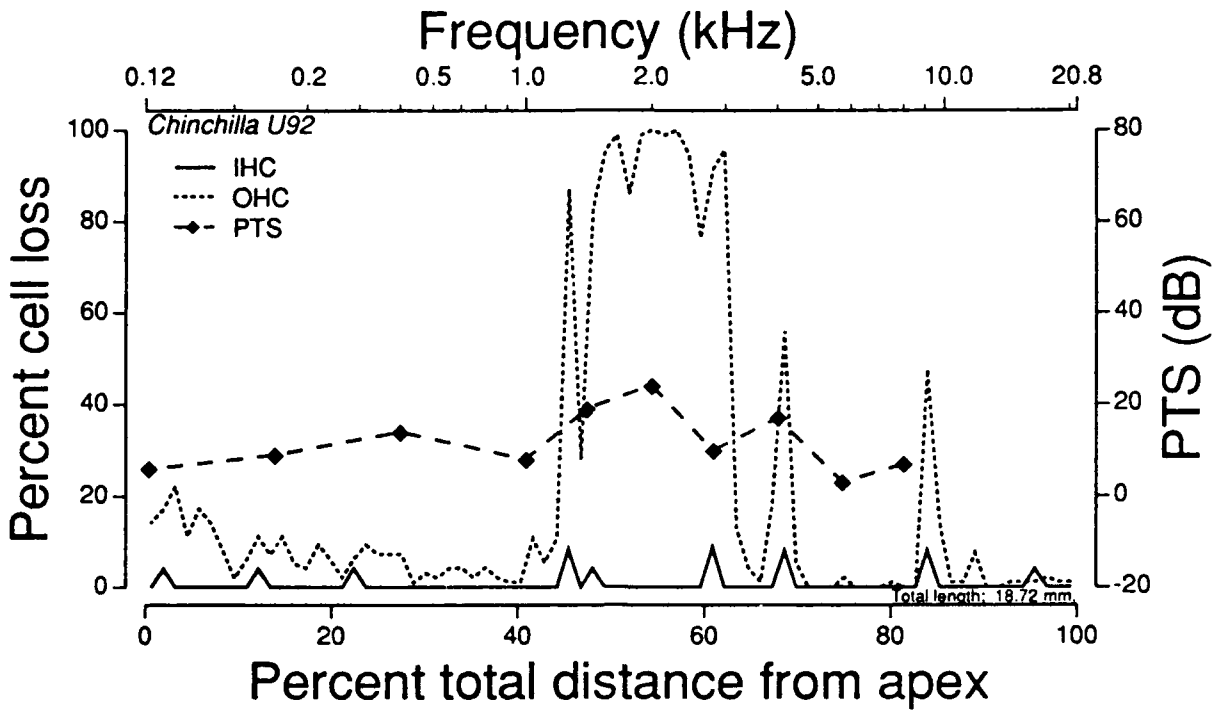
Percent sensory cell losses over octave band frequencies

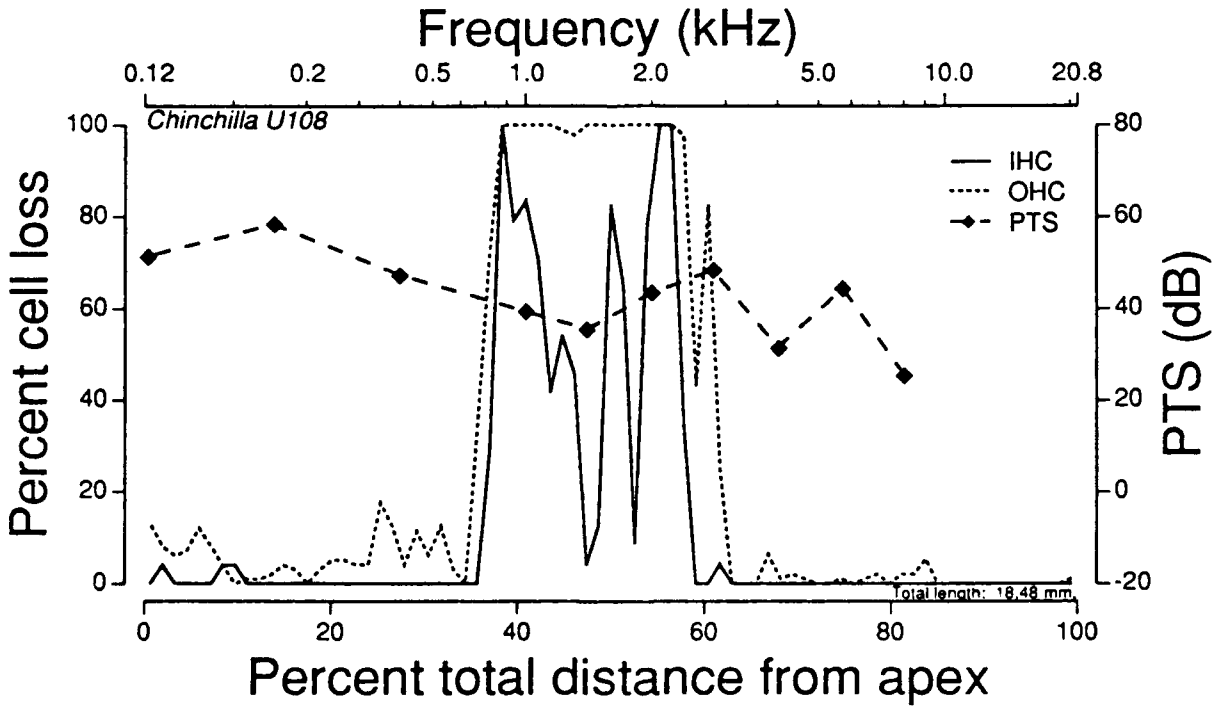
| | Inner hair cells | 1st row outer hair cells | 2nd row outer hair cells | 3rd row outer hair cells | Comb. outer hair cells | Inner pillar cells | Outer pillar cells |
|---|---|---|---|---|---|---|---|
| **Chinchilla U113** | | | | | | | |
| 0.125 kHz | 2.0 | 3.1 | 2.6 | 9.3 | 5.0 | 0.0 | 0.0 |
| 0.25 kHz | 0.8 | 3.2 | 0.0 | 2.6 | 1.9 | 0.0 | 0.0 |
| 0.5 kHz | 0.0 | 1.8 | 1.8 | 2.6 | 2.1 | 0.0 | 0.3 |
| 1 kHz | 0.4 | 2.5 | 2.2 | 1.5 | 2.1 | 0.0 | 0.3 |
| 2 kHz | 0.0 | 0.3 | 1.2 | 1.5 | 1.0 | 0.0 | 0.0 |
| 4 kHz | 0.0 | 0.0 | 0.6 | 1.5 | 0.7 | 0.0 | 0.0 |
| 8 kHz | 0.0 | 0.6 | 0.0 | 0.3 | 0.3 | 0.0 | 0.0 |
| 16 kHz | 0.0 | 1.0 | 0.3 | 0.0 | 0.4 | 0.0 | 0.0 |
| **Chinchilla U178** | | | | | | | |
| 0.125 kHz | 0.7 | 4.7 | 13.0 | 36.8 | 18.2 | 0.0 | 0.5 |
| 0.25 kHz | 1.2 | 0.3 | 1.2 | 13.9 | 5.1 | 0.0 | 0.0 |
| 0.5 kHz | 0.0 | 1.8 | 0.6 | 5.3 | 2.6 | 0.0 | 0.3 |
| 1 kHz | 1.2 | 46.7 | 40.2 | 16.2 | 34.4 | 0.6 | 1.2 |
| 2 kHz | 13.0 | 55.3 | 56.2 | 44.4 | 52.0 | 13.8 | 14.3 |
| 4 kHz | 0.8 | 0.9 | 1.2 | 1.2 | 1.1 | 0.0 | 0.0 |
| 8 kHz | 0.0 | 0.0 | 0.0 | 0.3 | 0.1 | 0.0 | 0.0 |
| 16 kHz | 0.0 | 1.4 | 0.0 | 0.0 | 0.5 | 0.0 | 0.0 |
| **Chinchilla U181** | | | | | | | |
| 0.125 kHz | 0.0 | 2.0 | 5.9 | 13.4 | 7.1 | 0.0 | 1.0 |
| 0.25 kHz | 0.0 | 0.8 | 0.8 | 11.6 | 4.4 | 0.0 | 0.3 |
| 0.5 kHz | 0.0 | 2.8 | 2.3 | 16.7 | 7.3 | 0.0 | 0.0 |
| 1 kHz | 21.8 | 81.0 | 78.9 | 58.3 | 72.7 | 31.4 | 28.9 |
| 2 kHz | 51.8 | 82.3 | 81.7 | 77.0 | 80.3 | 54.6 | 50.6 |
| 4 kHz | 1.1 | 90.4 | 95.3 | 81.3 | 89.0 | 0.2 | 0.0 |
| 8 kHz | 8.7 | 13.7 | 13.7 | 4.9 | 10.8 | 0.0 | 0.0 |
| 16 kHz | 0.0 | 2.0 | 0.3 | 0.3 | 0.9 | 0.0 | 0.0 |

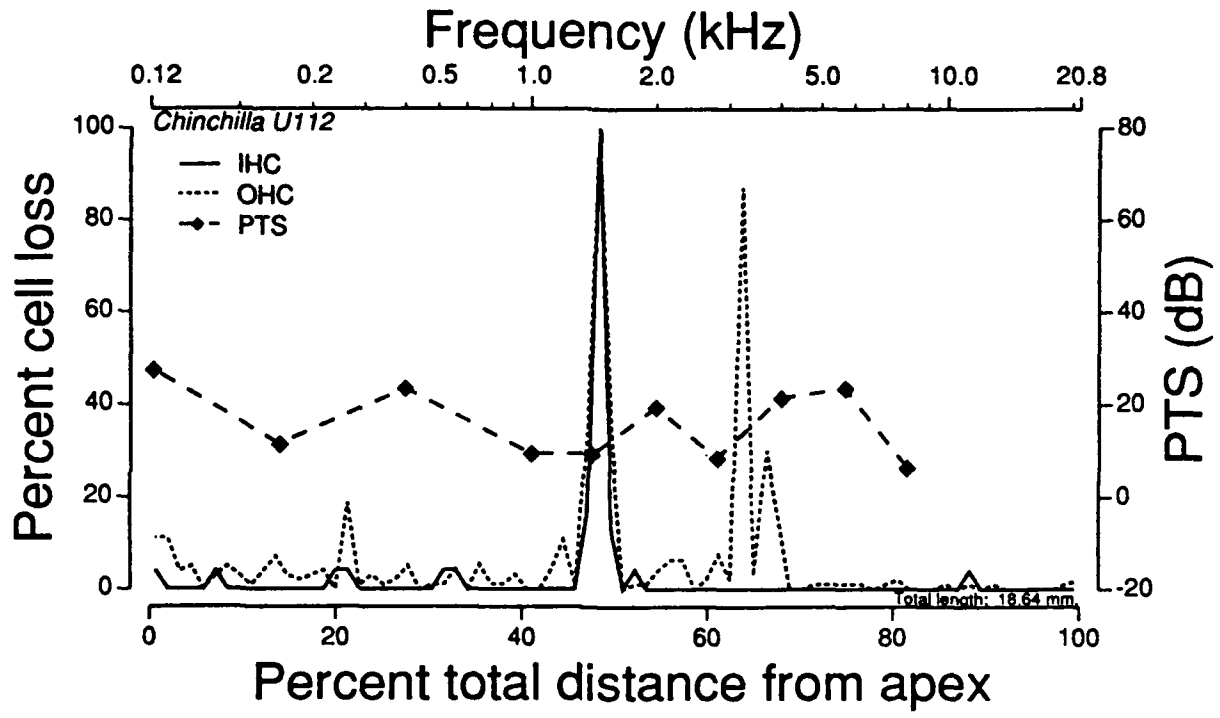
2075 Hz center frequency, 139 dB peak SPL

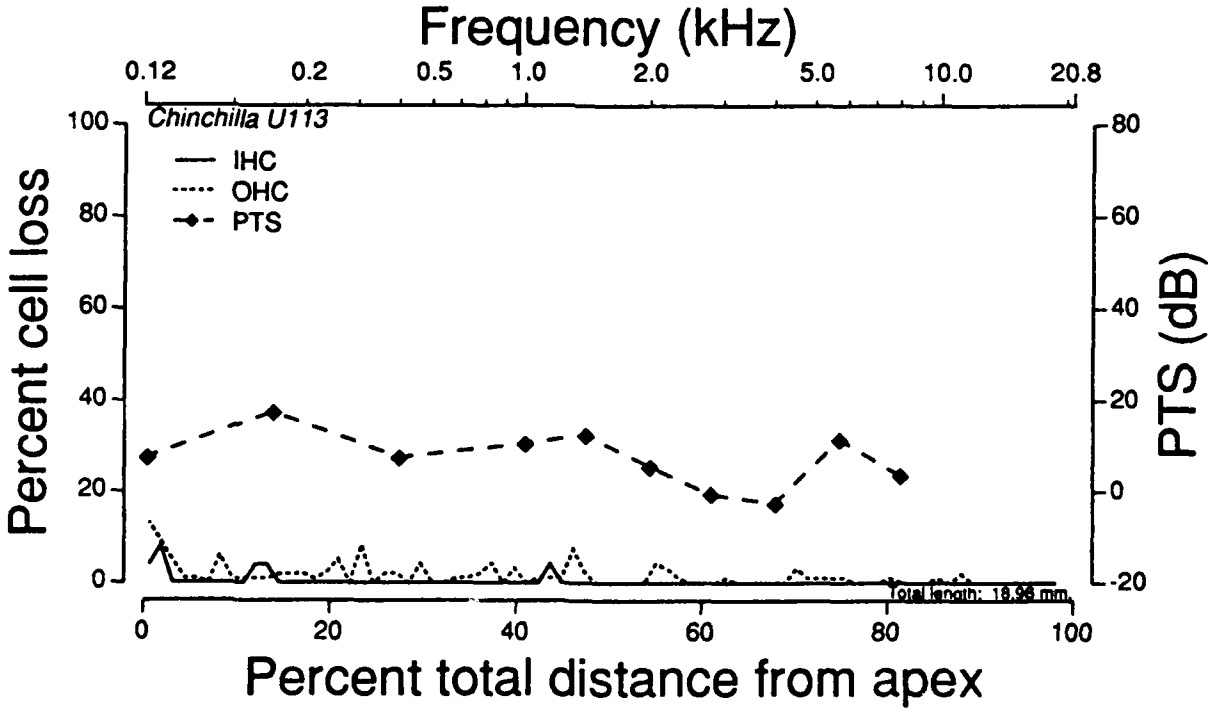
Percent sensory cell losses over octave band frequencies

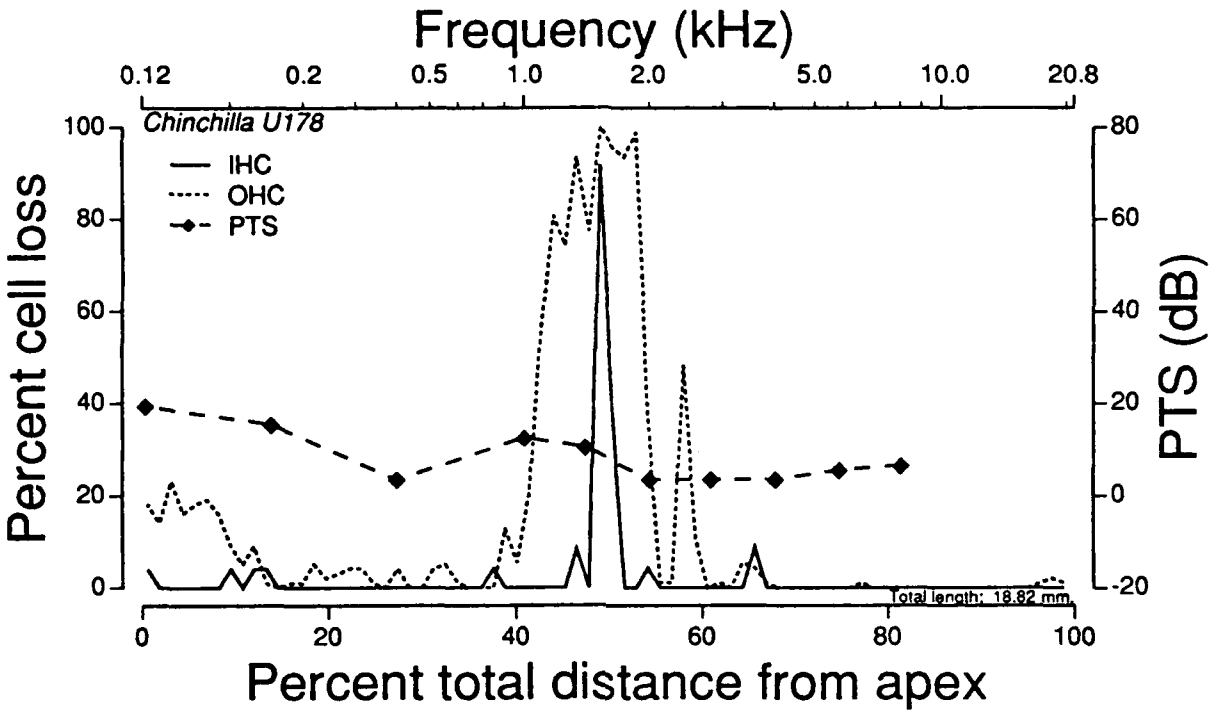
| | Inner hair cells | 1st row outer hair cells | 2nd row outer hair cells | 3rd row outer hair cells | Comb. outer hair cells | Inner pillar cells | Outer pillar cells |
|---|---|---|---|---|---|---|---|
| **Group means** | | | | | | | |
| 0.125 kHz | 0.92 | 3.12 | 7.08 | 20.57 | 10.26 | 0.00 | 0.67 |
| 0.25 kHz | 0.60 | 2.12 | 1.48 | 8.57 | 4.06 | 0.00 | 0.05 |
| 0.5 kHz | 0.27 | 3.80 | 3.50 | 6.82 | 4.71 | 0.00 | 0.20 |
| 1 kHz | 12.50 | 40.10 | 37.83 | 28.77 | 35.57 | 14.37 | 14.70 |
| 2 kHz | 20.68 | 57.58 | 57.63 | 52.03 | 55.75 | 21.57 | 22.62 |
| 4 kHz | 0.58 | 22.33 | 23.05 | 20.52 | 21.97 | 0.07 | 0.25 |
| 8 kHz | 1.58 | 3.87 | 3.55 | 2.28 | 3.23 | 0.03 | 0.20 |
| 16 kHz | 0.13 | 1.08 | 0.43 | 0.45 | 0.66 | 0.00 | 0.00 |
| **Group standard deviations** | | | | | | | |
| 0.125 kHz | 0.69 | 1.44 | 3.71 | 12.27 | 5.57 | 0.00 | 0.41 |
| 0.25 kHz | 0.42 | 2.01 | 1.24 | 5.16 | 1.89 | 0.00 | 0.12 |
| 0.5 kHz | 0.48 | 2.87 | 3.68 | 5.20 | 2.43 | 0.00 | 0.24 |
| 1 kHz | 20.01 | 37.64 | 36.07 | 32.71 | 35.11 | 22.12 | 22.96 |
| 2 kHz | 22.77 | 41.56 | 40.36 | 38.38 | 39.92 | 23.75 | 24.32 |
| 4 kHz | 0.53 | 34.62 | 36.45 | 30.77 | 33.94 | 0.10 | 0.61 |
| 8 kHz | 3.50 | 5.31 | 5.43 | 2.92 | 4.36 | 0.08 | 0.49 |
| 16 kHz | 0.21 | 0.69 | 0.49 | 0.82 | 0.54 | 0.00 | 0.00 |


Frequency (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
Chinchilla U92
IHC
OHC
PTS
Percent cell loss
PTS (dB)
Total length: 18.72 mm
Percent total distance from apex


Frequency (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
Chinchilla U108
IHC
OHC
PTS
Percent cell loss
PTS (dB)
Total length: 18.48 mm
Percent total distance from apex


Frequency (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
Chinchilla U112
IHC
OHC
PTS
Percent cell loss
PTS (dB)
Total length: 18.64 mm
0
20
40
60
80
100
-20
Percent total distance from apex


Frequency (kHz)
0.12
0.2
0.5
1.0
2.0
5.0
10.0
20.8
Chinchilla U113
IHC
OHC
PTS
Percent cell loss
PTS (dB)
Total length: 18.98 mm
0
20
40
60
80
100
-20
Percent total distance from apex


Frequency (kHz)
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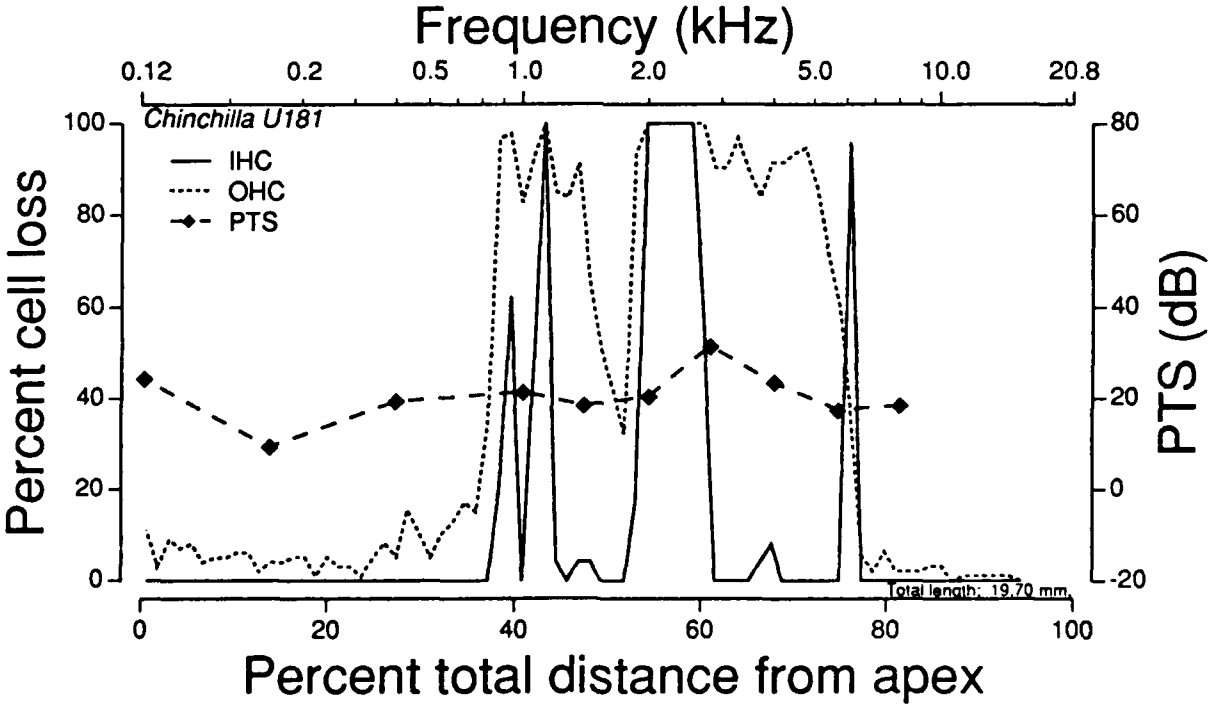
0.2
0.5
1.0
2.0
5.0
10.0
20.8
Chinchilla U178
IHC
OHC
PTS
Percent cell loss
PTS (dB)
Total length: 18.82 mm
0
20
40
60
80
100
-20
Percent total distance from apex


Frequency (kHz)
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0.2
0.5
1.0
2.0
5.0
10.0
20.8
Chinchilla U181
IHC
OHC
PTS
Percent cell loss
PTS (dB)
Total length: 19.70 mm
0
20
40
60
80
100
-20
Percent total distance from apex

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