Pressure in the cochlea during infrared irradiation

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Supporting information

Example for response spectra in the dish and the cochlea

Responses to laser pulses in the dish often can be separated into three components. As described in Results, the third component was considered as the component related to the pressure generated by the laser pulse. In case the first and second components were dominant as shown in Fig. 5, those components were removed by filtering the traces with a high pass filter in IGOR Pro. The frequency for the stop band was 4,000 Hz and for the pass band 5,000 Hz. The traces were then Fourier transformed to obtain the spectrum of the induced pressure pulse. All traces that did not contain the slow components in the pressure probe recordings were not high pass filtered. An example is shown in figure S1. The top panel presents the average response to 512 stimulus presentations. The gray traces are for the measurements in the dish and the black traces were obtained in the cadaveric cochlea. To compare the responses for the conditions, the ratio between the spectra obtained in the dish and in the cochlea were calculated and are shown in Fig. S1C. The gray trace

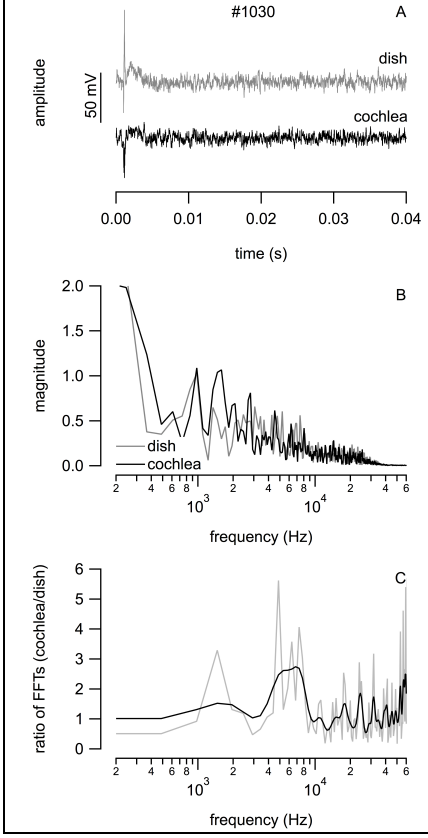

Fig. S1. (A) shows the traces recorded with the custom fabricate pressure probe (#1030) in the dish and in the cochlea. Note, the same probe is used for both measurements. Each of the 2 traces is the average of 512 responses to the corresponding number of laser pulses. (B) shows the frequency spectrum which was obtained through Fourier transformation of the traces shown in (A). From the plots it is difficult to determine differences in the spectrum obtained in the dish and the cochlea. Differences between the measurements in the cochlea and the dish can be enhanced by calculating the ratio between the two spectra and is shown in (C) with the light gray line. The dark black line is smoothed gray trace using a binomial (Gaussian) smoothing algorithm provided in IGOR Pro (WaveMetrics, Lake Oswego, OR). This cochlea shows a distinct frequency pattern. However, as shown below, this pattern is different for each cochlea.

shows the ratio of the two spectra, the black line is the smoothed ratio after applying a binomial (Gaussian) smoothing algorithm provided in IGOR Pro (WaveMetrics, Lake Oswego, OR). A cochlear specific change in spectrum can be seen.

Response spectra in the dish

A described above, the frequency spectrum for each measurement in the dish was determined. The traces for each measurement are shown below. The response at ~45 kHz comes from the response properties of the pressure probe. As described in Results (A. 2), the pressure probe had three responses. The third component was considered as the relevant response, which was uncovered after filtering as described above. One has to consider this data processing when examining the response spectra. Response measured with probes #0315 and #0309 were processed by this method. The remaining recordings were like shown in Fig. S1. No high pass filter was applied to the traces.

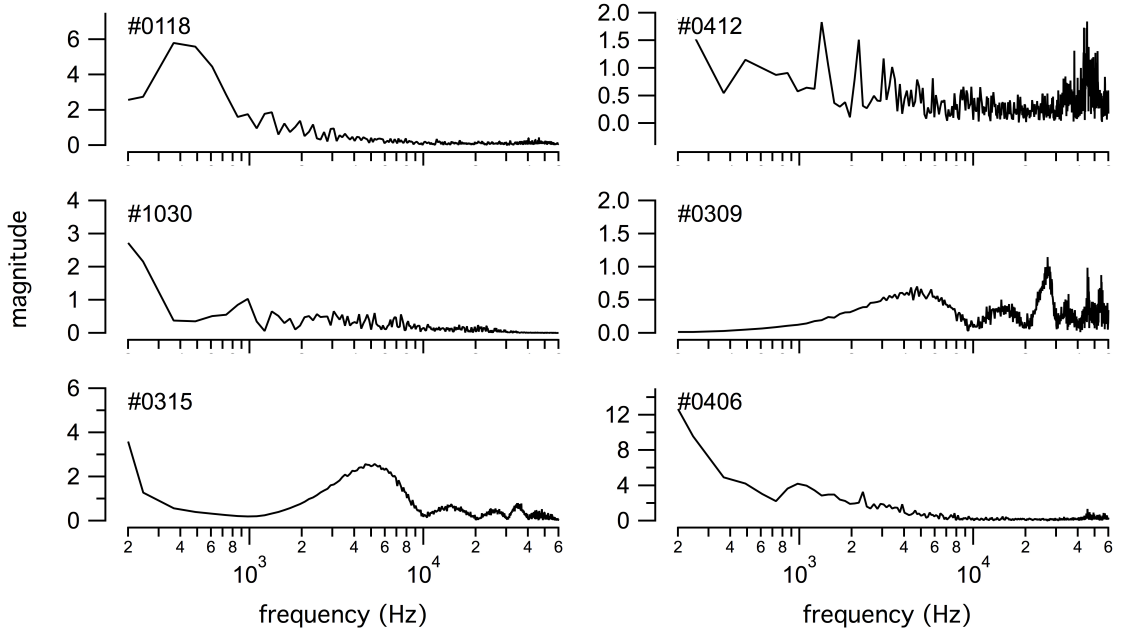

Fig. S2. The traces show the frequency spectra, which were obtained through Fast Fourier Transformation (FFT) of the responses recorded in the dish. For all FFTs 2046 points were used. Probes #0309 and #0315 were in the beam path and the components 1 and 2 were removed by applying a high pass filter with a corner frequency of 4000 Hz.

Response spectra in the cochlea

A described above, the frequency spectrum for each measurement in the cochlea (see also Table 1) was determined. The traces for each measurement are shown below. The response at ~45 kHz comes from the response properties of the pressure probe.

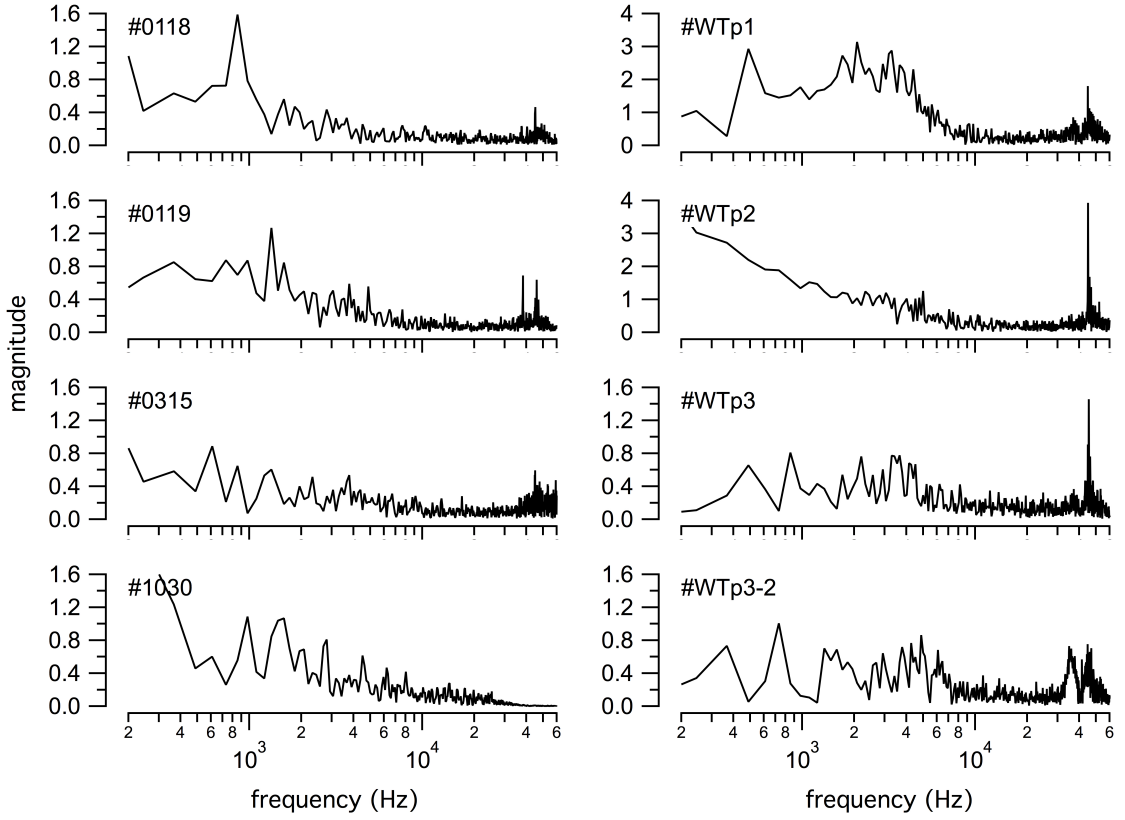

Fig. S3. The traces show the frequency spectra, which were obtained through Fast Fourier Transformation (FFT) of the responses recorded in the cochleae listed in Table 1. For all FFTs 2046 points were used.

Response spectra in the cochlea versus dish

For three probes the measurements were completed in both, the dish and in the cochlea. A direct comparison of the spectra was possible for those cases (see Fig. S4). Although the spectra changed when compared between the dish and the cochlea, they were also different among different cochleae. A direct prediction of the resulting spectra was not possible based on the present measurements.

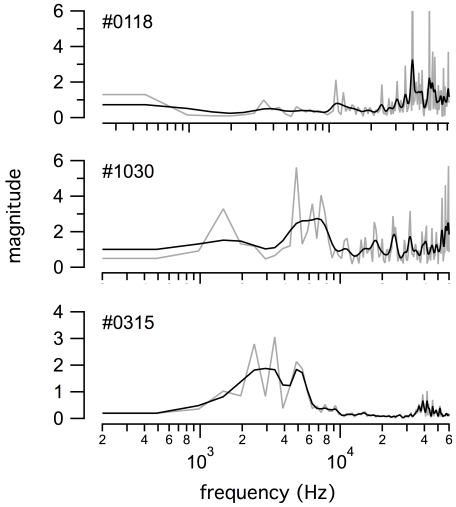

Fig. S4. Ratios between the response spectra in the dish and the cochleae are shown with the light gray line. The dark black line is the smoothed gray trace using a binomial (Gaussian) smoothing algorithm provided in IGOR Pro. The cochlea shows a distinct frequency pattern. However, this pattern is different for each cochlea.