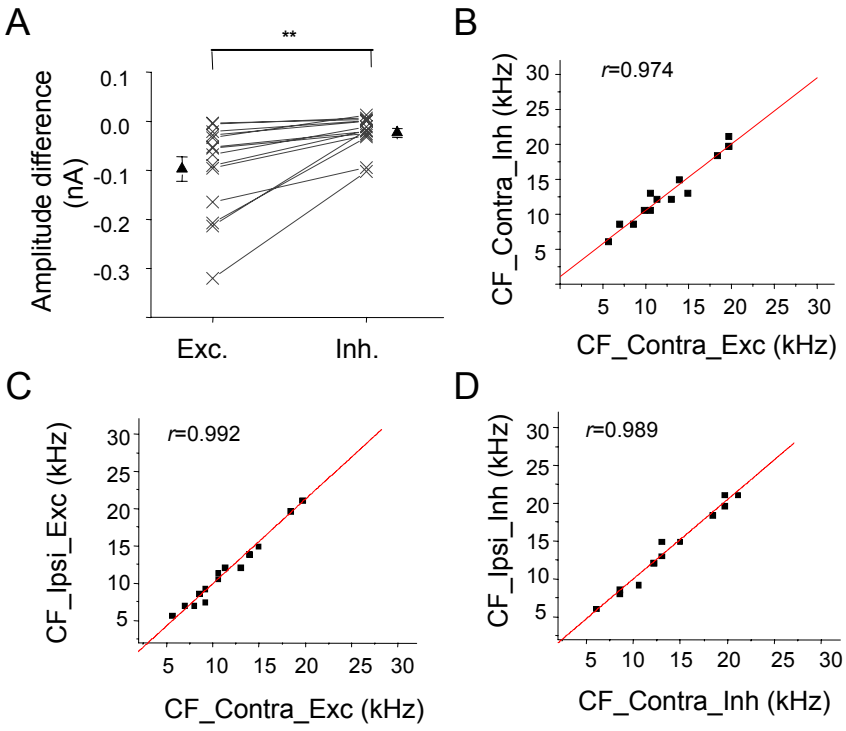


Figure S1. Comparison of synaptic TRFs and response amplitudes. (Related to Figure 2).
(A) Absolute amplitude difference of monaurally evoked excitatory and inhibitory responses (Ipsi - Contra). **p < 0.001, paired t-test, n = 14.
(B) CF of contralateral inhibitory TRF vs. that of contralateral excitatory TRF.
(C) CF of ipsilateral excitatory TRF vs. that of contralateral excitatory TRF.
(D) CF of ipsilateral inhibitory TRF vs. that of contralateral inhibitory TRF.

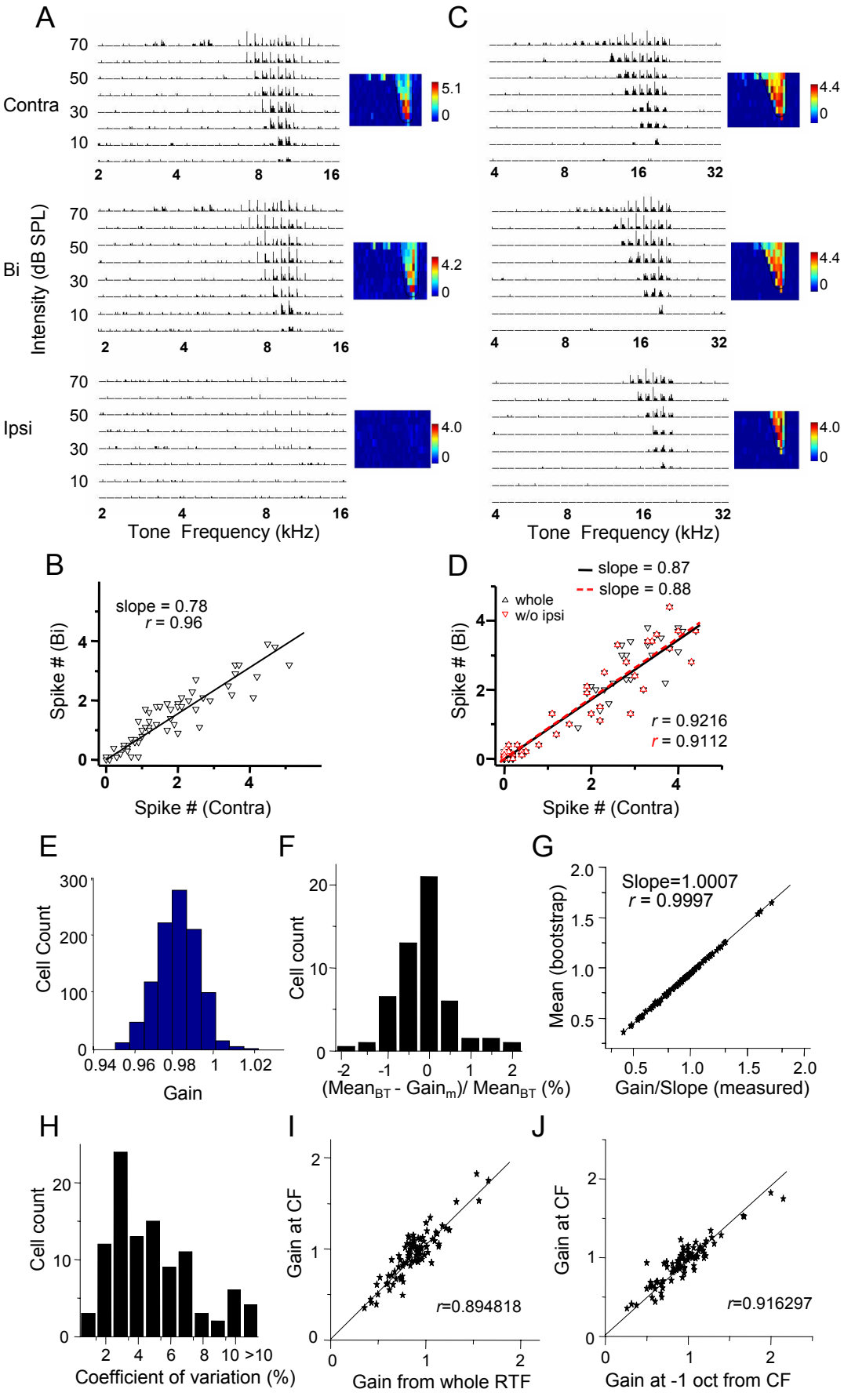
A
C
Contra
Bi
Ipsi
Intensity (dB SPL)
70
50
30
10
2
4
8
16
32
5.1
4.2
4.0
4.4
0
Tone Frequency (kHz)
B
slope = 0.78
r = 0.96
Spike # (Bi)
Spike # (Contra)
D
slope = 0.87
slope = 0.88
whole
w/o ipsi
r = 0.9216
r = 0.9112
E
Cell Count
Gain
F
Cell count
(Mean_BT - Gain_m)/ Mean_BT (%)
G
Slope=1.0007
r = 0.9997
Mean (bootstrap)
Gain/Slope (measured)
H
Cell count
Coefficient of variation (%)
I
Gain at CF
r=0.894818
Gain from whole RTF
J
Gain at CF
r=0.916297
Gain at -1 oct from CF

Figure S2. Monaural and binaural TRFs of two more example ICC neurons and bootstrap analysis. (Related to Figure 3).
(A) Spike TRFs of a monaural cell. Data are displayed in the same manner as in Figure 3A. Color map depicts the average evoked spike number.
(B) Correlation between binaural and contralateral responses for the cell shown in (A). The best-fit linear regression line is shown.
(C) Spike TRFs of a binaural cell.
(D) Correlation between binaural and contralateral responses for the binaural cell shown in (C). Responses were from the entire TRF (whole), or from the TRF region where there were no ipsilateral spiking responses (w/o ipsi). There is no significant difference between the two slopes (bootstrap analysis).
(E) Distribution of bootstrapped gain values (1000 bootstrap samplings) for the example cell shown in Figure 3A.
(F) Distribution of the relative difference between the measured gain and the mean of bootstrapped gain values (1000 bootstrap samplings). Note that the measured gain is very close to the mean of bootstrapped gain values (within $\pm$2%).
(G) The mean of bootstrapped gain values (1000 bootstrap samplings) plotted against the measured gain value. Each data point represents one cell. The best-fit linear regression line is shown.
(H) Distribution of the coefficient of variation (in percentage) of bootstrapped gain values (1000 bootstrap samplings). The coefficient of variation is defined as SD/mean.
(I) Comparison of gain values measured for the whole TRF and from responses to CF tones at 60 dB SPL. ($p=0.47$, $n=89$, paired t-test).
(J) Comparison of gain values measured from responses to CF tones and from tones 1 octave lower than CF, at the intensity of 60 dB SPL ($p=0.69$, $n=89$, paired t-test).

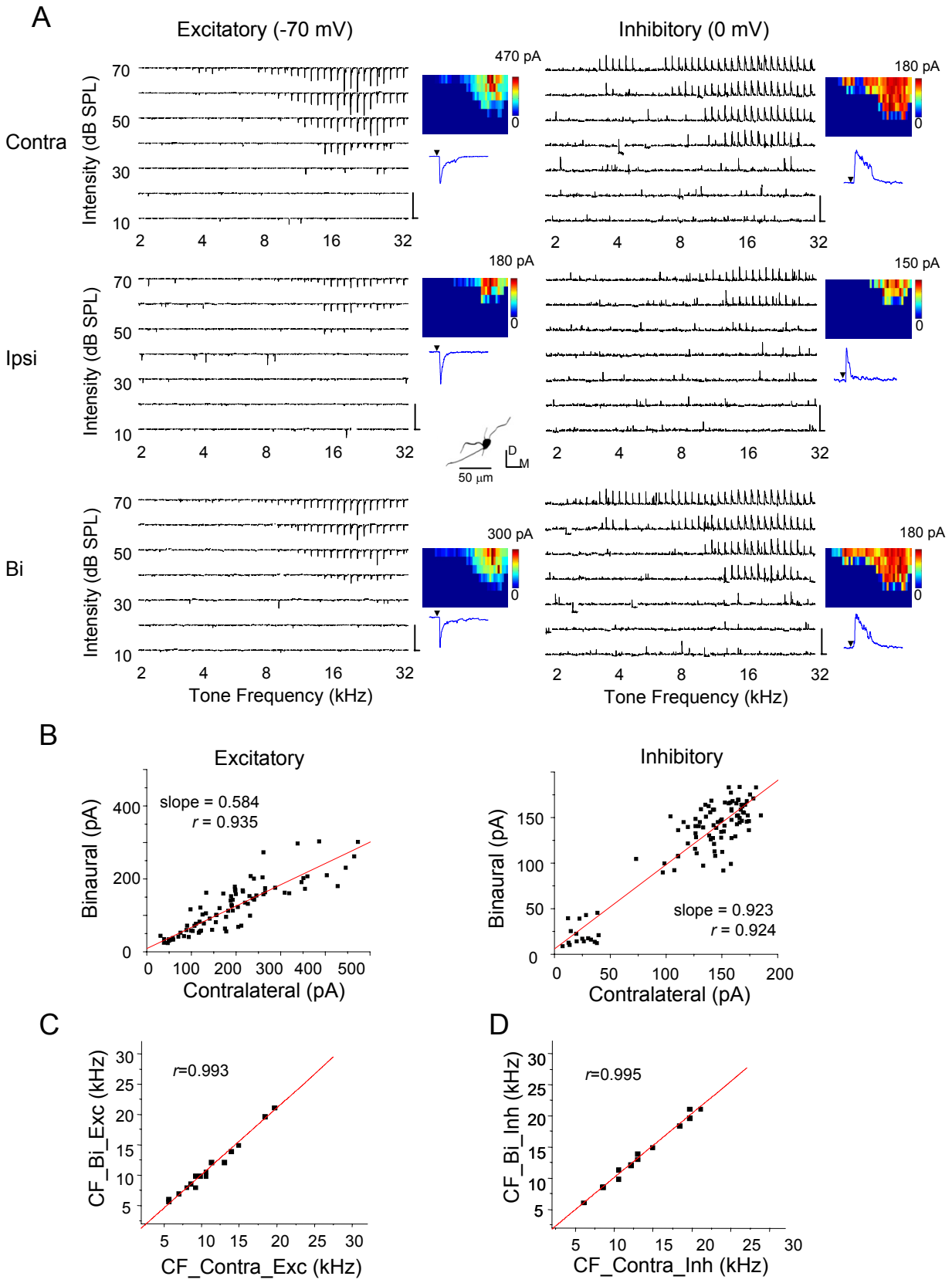
A
Excitatory (-70 mV)
Inhibitory (0 mV)
Contra
Ipsi
Bi
Intensity (dB SPL)
70
50
30
10
2
4
8
16
32
Tone Frequency (kHz)
470 pA
180 pA
150 pA
300 pA
50 μm
D
M
B
Excitatory
slope = 0.584
r = 0.935
Binaural (pA)
Contralateral (pA)
Inhibitory
slope = 0.923
r = 0.924
C
r=0.993
CF_Bi_Exc (kHz)
CF_Contra_Exc (kHz)
D
r=0.995
CF_Bi_Inh (kHz)
CF_Contra_Inh (kHz)

Figure S3. Monaural and binaural synaptic responses of another example ICC neuron and comparison between binaural and contralateral synaptic TRFs. (Related to Figure 4).
(A) Synaptic TRFs of a binaural cell. Data are displayed in the same manner as in Figure 4A. Color map depicts the average peak amplitude. Scale, 500 (Exc) / 200 (Inh) pA, 350 ms. The arrows on the sample traces represent the onset of tones.
(B) Correlation between the binaural and contralateral synaptic response amplitudes for the cell shown in (A).
(C) CF of binaural excitatory TRF vs. that of contralateral excitatory TRF.
(D) CF of binaural inhibitory TRF vs. that of contralateral inhibitory TRF.

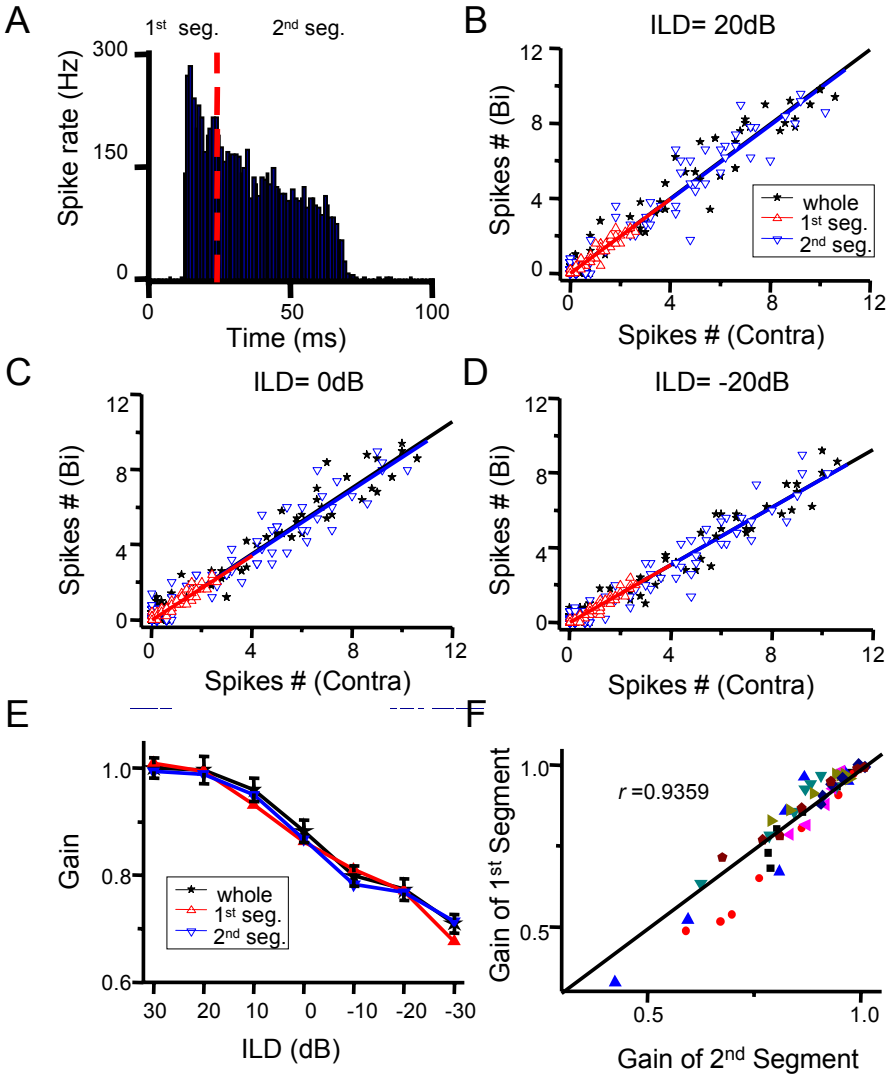


Figure S4. The ipsilateral gain modulation is temporally constant. (related to Figure 6).
(A)PSTH of a recorded ICC neuron. The PSTH was divided into 2 segments. The first segment is the first 10 ms of the response. The second segment is the rest of response duration.
(B) Correlation between the binaural and contralateral responses of the same cell at ILD = 20 dB. The gains measured within the 1st, 2nd segment and in the whole duration were consistent with each other.
(C) Same analysis at ILD= 0dB.
(D) Same analysis at ILD= -20dB.
(E) The gains in different temporal segments averaged for 8 recorded cells. Note that the three curves are consistent with each other.
(F) Correlation between the gains of the 1st and 2nd temporal segments at all ILD levels. Note that the linearity between the gains of the two segments is strong ($r$ =0.9359).