Supplementary Figure 1: ON and OFF-type ELL pyramidal cells display similar responses to second order attributes of natural electrosensory stimuli. A: Example responses of example ON-type (green) and OFF-type (brown) ELL pyramidal cells to a 4 Hz sinusoidal AM (black). B: Distribution of stimulus phase for which ELL pyramidal cells in our dataset fired preferentially. The distribution is clearly bimodal (Hartigan’s dip test, p=0.0167) with ON-type cells firing preferentially near the maximum of the stimulus (phase 0) and OFF-type cells firing preferentially near the minimum (phase π). C: The population-averaged response power spectrum (green) for ON (left) and (brown) OFF (right) type cells was relatively constant as compared to that of the envelope stimulus (blue). Insets: The population-averaged response autocorrelation function (green) for ON (left) and (brown) OFF (right) type cells decayed to zero much faster than that of the stimulus (blue). D: Population-averaged correlation times (left) and white index (right) for ON (green) and OFF (brown) type cells. No significant differences were observed between correlation time (Wilcoxon rank-sum test, p>0.05, n.s., N=14) or white index values (Wilcoxon rank-sum test, p>0.05, n.s., N=14).
Supplementary Figure 2: UCL and EBIO application have opposite effects on pyramidal neuron baseline activity. A) Glutamate ejection causes rapid increases in pyramidal neuron firing rate, indicating that the pharmacology electrode is close to the neuron from which we are recording. B) Baseline activity under control (top) and after UCL application (bottom) from a typical pyramidal neuron. C) Same as B for EBIO application. D) Population-averaged burst fractions under baseline (control) and after UCL and EBIO application, respectively. Burst fraction was significantly different between control and UCL (Wilcoxon rank-sum test, p<0.05, N=6) and between control and EBIO (Wilcoxon rank-sum test, p<0.05, N=6).
Supplementary Figure 3: Saline injection does not significantly alter behavioral responses to envelope stimuli.

A) Schematic showing the bilateral saline injection. B) Top: Low (left) and high (right) frequency envelope stimuli. Bottom: Corresponding behavioral responses before (green) and after (red) saline injection. C) Population-averaged behavioral sensitivity before (green) and after (red) saline injection. The dashed lines show the best power law fits to the data. Inset: Population-averaged power law exponents for before (green) and after saline injection (red) (N=3). D) Population-averaged phase lag before (green) and after (red) saline injection (N=3).