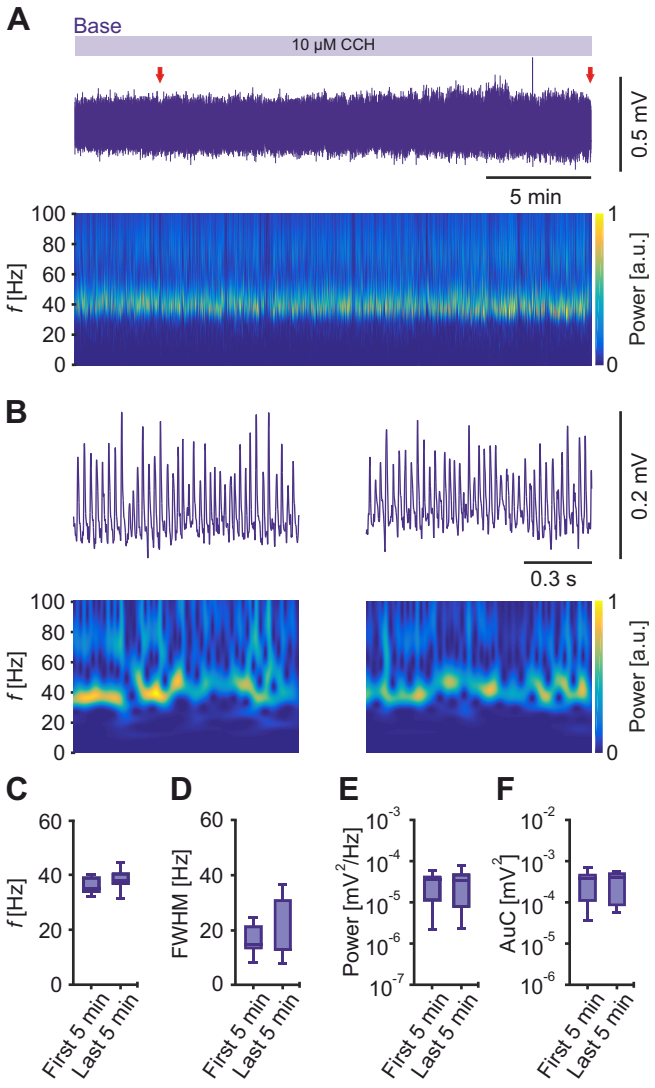
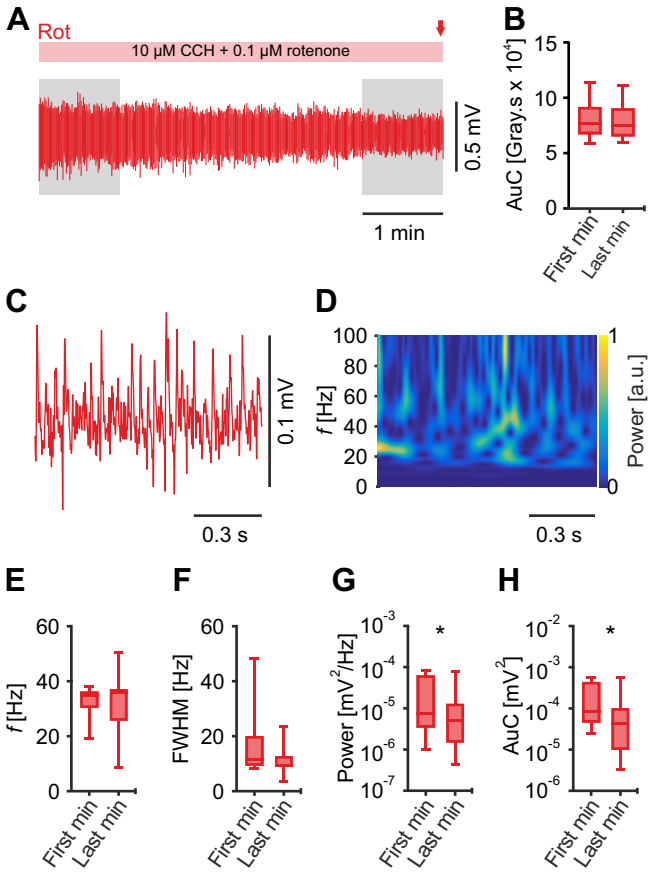
Supplementary Figure 1



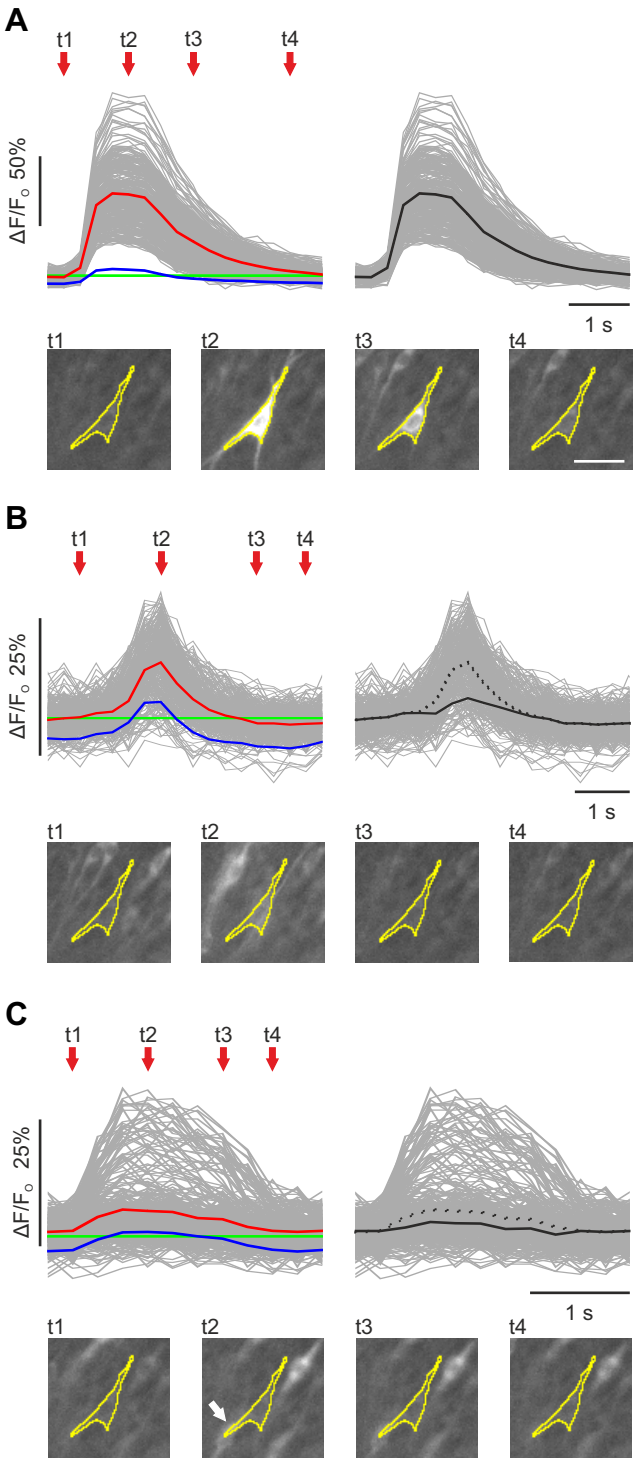
Supplementary Figure 1. Stable gamma oscillations can be induced persistently in submerged condition. (A) Sample trace of LFP recording during gamma oscillation (top). Red arrows indicate time points in **(B)** at higher temporal resolution. Corresponding wavelet transformations (bottom) showing the power of frequency domains over time. Heat-scale colours encode for power in arbitrary units (a.u.). Gamma oscillations were analysed for different parameters for the first and last 5 minutes of the recordings. n/N slices/preparations: 7/2. **(C)** Peak frequency (*f*), paired *t*-test. **(D)** Full width at half-maximum (FWHM), Wilcoxon matched-pairs signed-rank test. **(E)** Peak of power spectral density (Power), paired *t*-test. **(F)** Area under the curve (AuC), paired *t*-test. This experiment was conducted within 2-3 weeks *in vitro*. Data are summarised by their median ± the interquartile range (IQR = 75 % percentile – 25 % percentile), error bars indicate minimal and maximal values.

Supplementary Figure 2



Supplementary Figure 2. Metabolic stress induced by rotenone is dynamic but mild. (A) Sample trace of LFP recording during mild metabolic stress. Grey rectangles (one minute each) indicate time windows compared in the following statistics. n/N slices/preparations: 8/3. Red arrows indicate time points in **(C)** at higher temporal resolution and corresponding wavelet transformations showing the power of frequency domains over time in **(D)**. **(D)** Area under the curve for calcium fluorescence reflecting the overall activity of pyramidal cells, paired *t*-test. Gamma oscillations were analysed for different parameters. **(E)** Peak frequency (*f*). **(F)** Full width at half maximum (FWHM). **(G)** Peak of power spectral density (Power). **(H)** Area under the curve (AuC), (E-F) Wilcoxon matched-pairs signed-rank test. Note the difference between AuC in (B) (calcium fluorescence of pyramidal cells) and AuC in (F) (derived from power spectra of LFP). * $p < 0.05$. Data are summarised by their median ± the interquartile range (IQR = 75 % percentile – 25 % percentile), error bars indicate minimal and maximal values.

Supplementary Figure 3



Supplementary Figure 3. Algorithm for reducing cross-contamination of the calcium fluorescence signal. Three possible conditions can occur, true signal (A), contamination with complete overlap with the region of interest (ROI) because of background activity (B), or partial contamination due to overlap with active neighbouring cells (C). **(A)** Light grey traces (top) represent calcium fluorescence transients of all pixels within the ROI marked with yellow (bottom). Red, green and blue traces (top left) represent average calcium fluorescence within ROI, baseline and average calcium fluorescence of ROI's surrounding border respectively. The black line (top right) shows the output of the algorithm. At the bottom, the four time points are marked with red arrows (top left) indicating that observed signal is a true intrinsic activity of the ROI. **(B)** Dashed black line (top right) indicate contaminated signal (equal to the red line, left). The solid black line shows the output of the algorithm. **(C)** Note the active neighbouring cell (white arrow at 't2', bottom) overlapping with ROI. Scale bar 20 μm.

Supplementary Table 1 Parameters used in Wave_Clus, spike sorting Matlab algorithm.

par.segments_length	5
par.sr	20000
par.cont_segment	true
par.max_spikes_plot	1000
par.print2file	true
par.cont_plot_samples	100000
par.to_plot_std	1
par.all_classes_ax	'mean’
par.plot_feature_stats	false
par.mintemp	0.00
par.maxtemp	0.251
par.tempstep	0.01
par.SWCycles	100
par.KNearNeighb	11
par.min_clus	20
par.max_clus	200
par.randomseed	0
par.temp_plot	'log'
par.c_ov	0.7
par.elbow_min	0.4
par.tmax	'all'
par.tmin	0
par.w_pre	20
par.w_post	44
par.alignment_window	10
par.stdmin	5
par.stdmax	50
par.detect_fmin	300
par.detect_fmax	3000
par.detect_order	4
par.sort_fmin	300
par.sort_fmax	3000
par.sort_order	2
par.ref_ms	1.5
par.detection	'neg'
par.int_factor	5
par.interpolation	'y'
par.min_inputs	10
par.max_inputs	0.75
par.scales	4
par.features	'wav'
par.template_sdnum	3
par.template_k	10
par.template_k_min	10
par.template_type	'center’
par.force_feature	'spk'
par.force_auto	false
par.match	'n'
par.max_spk	4000000
par.permut	'n'
par.nbins	100
par.bin_step	1