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Reporting Checklist for Nature Neuroscience

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Please note that in the event of publication, it is mandatory that authors include all relevant methodological and statistical information in the manuscript.

Statistics reporting, by figure

- Please specify the following information for each panel reporting quantitative data, and where each item is reported (section, e.g. Results, & paragraph number).
- Each figure legend should ideally contain an exact sample size (n) for each experimental group/condition, where n is an exact number and not a range, a clear definition of how n is defined (for example x cells from x slices from x animals from x litters, collected over x days), a description of the statistical test used, the results of the tests, any descriptive statistics and clearly defined error bars if applicable.
- For any experiments using custom statistics, please indicate the test used and stats obtained for each experiment.
- Each figure legend should include a statement of how many times the experiment shown was replicated in the lab; the details of sample collection should be sufficiently clear so that the replicability of the experiment is obvious to the reader.
- For experiments reported in the text but not in the figures, please use the paragraph number instead of the figure number.

Note: Mean and standard deviation are not appropriate on small samples, and plotting independent data points is usually more informative. When technical replicates are reported, error and significance measures reflect the experimental variability and not the variability of the biological process; it is misleading not to state this clearly.

		TEST USED		n			DESCRIPTIVE STATS (AVERAGE, VARIANCE)		P VALUE		DEGREES OF FREEDOM & F/t/z/R/ETC VALUE	
	FIGURE NUMBER	WHICH TEST?	SECTION & PARAGRAPH #	EXACT VALUE	DEFINED?	SECTION & PARAGRAPH #	REPORTED?	SECTION & PARAGRAPH #	EXACT VALUE	SECTION & PARAGRAPH #	VALUE	SECTION & PARAGRAPH #
example	1a	one-way ANOVA	Fig. legend	9, 9, 10, 15	mice from at least 3 litters/group	Methods para 8	error bars are mean +/- SEM	Fig. legend	p = 0.044	Fig. legend	F(3, 36) = 2.97	Fig. legend
example	results, para 6	unpaired t-test	Results para 6	15	slices from 10 mice	Results para 6	error bars are mean +/- SEM	Results para 6	p = 0.0006	Results para 6	t(28) = 2.808	Results para 6
+ -	1b	two-tailed unpaired t-test	Fig. legend	14,7	rats	Fig. legend	mean ± C.I.	Fig. legend	p=0.0167	Fig. legend	t=2.623	Fig. legend

		TEST USED		n			DESCRIPTIVE STATS (AVERAGE, VARIANCE)		P VALUE		DEGREES OF FREEDOM & F/t/z/R/ETC VALUE	
	FIGURE NUMBER	WHICH TEST?	SECTION & PARAGRAPH #	EXACT VALUE	DEFINED?	SECTION & PARAGRAPH #	REPORTED?	SECTION & PARAGRAPH #	EXACT VALUE	SECTION & PARAGRAPH #	VALUE	SECTION & PARAGRAPH #
+ -	1b	two-tailed unpaired t-test	Fig. legend	14,7	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.0128	Fig. legend	t=2.749	Fig. legend
+ -	1c	two-way RM-ANOVA	Fig. legend	14,7	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.0108	Fig. legend	F(1,19)=7.988	Fig. legend
+ -	1d	two-tailed unpaired t-test	Fig. legend	14,7	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.0045	Fig. legend	t=3.219	Fig. legend
+ -	1e	two-way RM-ANOVA	Fig. legend	14,7	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.0038	Fig. legend	F(1,19)=15.15	Fig. legend
+ -	2e	two-tailed unpaired t-test	Fig. legend	53,23	neurons	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.001	Fig. legend	t=3.41	Fig. legend
+ -	2e	two-tailed unpaired t-test	Fig. legend	19,20	tracks	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.0006	Fig. legend	t=3.736	Fig. legend
+ -	2f	two-tailed unpaired t-test	Fig. legend	25,20	neurons	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.0004	Fig. legend	t=3.878	Fig. legend
+ -	2f	two-tailed unpaired t-test	Fig. legend	25,46	tracks	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.0045	Fig. legend	t=2.940	Fig. legend
+ -	2g	two-tailed unpaired t-test	Fig. legend	25,22	neurons	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.745	Fig. legend	t=0.328	Fig. legend
+ -	2g	two-tailed unpaired t-test	Fig. legend	18,19	neurons	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.934	Fig. legend	t=0.084	Fig. legend
+ -	3a	one-way ANOVA	Fig. legend	8,7,7	rats	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.02	Fig. legend	F(2,19)=4.74	Fig. legend
+ -	3a	one-way ANOVA	Fig. legend	8,7,7	rats	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.0178	Fig. legend	F(2,19)=5.015	Fig. legend
+ -	3b	two-way RM-ANOVA	Fig. legend	8,7,7	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.0034	Fig. legend	F(10,95)=2.89	Fig. legend
+ -	3c	one-way ANOVA	Fig. legend	8,7,7	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.028	Fig. legend	F(2,19)=4.38	Fig. legend
+ -	3d	two-way RM-ANOVA	Fig. legend	8,7,7	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p<0.0001	Fig. legend	F(2,19)=19.74	Fig. legend
+ -	3e	two-tailed unpaired t-test	Fig. legend	10,9	rats	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.447	Fig. legend	t=0.778	Fig. legend
+ -	3f	two-way RM-ANOVA	Fig. legend	8,10,9	rats	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.0233	Fig. legend	F(5,85)=2.76	Fig. legend
+ -	3g	two-tailed unpaired t-test	Fig. legend	10,9	rats	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.667	Fig. legend	t=0.438	Fig. legend
+ -	3h	two-way RM-ANOVA	Fig. legend	10,9	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.0038	Fig. legend	F(1,16)=11.41	Fig. legend
+ -	3j	two-way RM-ANOVA	Fig. legend	9,13	rats	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.0001	Fig. legend	F(1,20)=23.18	Fig. legend
+ -	3k	one-way ANOVA	Fig. legend	9,13,5	rats	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.0116	Fig. legend	F(2,24)=5.397	Fig. legend

+ -	3l	two-way RM-ANOVA	Fig. legend	9,13	rats	Fig. legend	mean ± 95% C.I.	Fig. legend	p<0.0001	Fig. legend	F(1,20)=25.39	Fig. legend
+ -	S5a	two-way RM-ANOVA	Fig. legend	7,7,7	rats	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.063	Fig. legend	F(2,19)=3.21	Fig. legend
+ -	S5a	two-way RM-ANOVA	Fig. legend	7,7,7	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.902	Fig. legend	F(2,19)=0.104	Fig. legend
+ -	S5b	two-way RM-ANOVA	Fig. legend	7,7,7	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.033	Fig. legend	F(2,19)=4.14	Fig. legend
+ -	S5b	one-way ANOVA	Fig. legend	7,7,7	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.033	Fig. legend	F(2,19)=4.11	Fig. legend
+ -	S5c	two-way RM-ANOVA	Fig. legend	7,6,7	rats	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.465	Fig. legend	F(2,18)=0.799	Fig. legend
+ -	S5c	two-way RM-ANOVA	Fig. legend	7,6,7	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.638	Fig. legend	F(2,18)=0.460	Fig. legend
+ -	S5d	two-way RM-ANOVA	Fig. legend	7,6,7	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.983	Fig. legend	F(2,18)=0.017	Fig. legend
+ -	S5d	one-way ANOVA	Fig. legend	7,6,7	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.983	Fig. legend	F(2,18)=0.017	Fig. legend
+ -	S5e	one-way ANOVA	Fig. legend	6,6,6,7	rats	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.921	Fig. legend	F(3,21)=0.162	Fig. legend
+ -	S5f	one-way ANOVA	Fig. legend	6,6,6,7	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.922	Fig. legend	F(3,21)=0.159	Fig. legend
+ -	S5f	one-way ANOVA	Fig. legend	6,6,6,7	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.879	Fig. legend	F(3,21)=0.224	Fig. legend
+ -	4c	Pearson r	Fig. legend	9	rats	Fig. legend	individual data	Fig. legend	p=0.01	Fig. legend	R square=0.64	Fig. legend
+ -	5b	two-way RM-ANOVA	Fig. legend	16,11	neurons	Fig. legend	mean ± 95% C.I.	Fig. legend	p<0.0001	Fig. legend	F(78,1950)=2.744	Fig. legend
+ -	5c	two-way RM-ANOVA	Fig. legend	16,11	same neurons as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.0002	Fig. legend	F(4,125)=6.05	Fig. legend
+ -	5d	two-way RM-ANOVA	Fig. legend	16,11	rats	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.0043	Fig. legend	F(4,100)=4.06	Fig. legend
+ -	5e	two-tailed unpaired t-test	Fig. legend	36,59	neurons	Fig. legend	mean ± 95% C.I..	Fig. legend	p=0.0005	Fig. legend	t=3.583	Fig. legend
+ -	6a	two-way RM-ANOVA	Fig. legend	11,12	neurons	Fig. legend	mean ± 95% C.I.	Fig. legend	p<0.001	Fig. legend	F(4,84)=18.8	Fig. legend
+ -	6b	two-tailed unpaired t-test	Fig. legend	19,18	neurons	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.0004	Fig. legend	t=3.875	Fig. legend
+ -	6c	two-tailed unpaired t-test	Fig. legend	19,18	same neurons as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.129	Fig. legend	t=1.556	Fig. legend
+ -	6d	two-tailed unpaired t-test	Fig. legend	10,12	neurons	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.015	Fig. legend	t=2.66	Fig. legend
+ -	6d	two-tailed unpaired t-test	Fig. legend	22,23	neurons	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.0049	Fig. legend	t=2.965	Fig. legend
+ -	6f	two-tailed unpaired t-test	Fig. legend	17,19	neurons	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.397	Fig. legend	t=0.859	Fig. legend
+ -	6f	two-tailed unpaired t-test	Fig. legend	17,19	same neurons as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.457	Fig. legend	t=0.753	Fig. legend
+ -	7a	two-tailed unpaired t-test	Fig. legend	16,16	rats	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.814	Fig. legend	t=0.238	Fig. legend
+ -	7a	two-tailed unpaired t-test	Fig. legend	16,16	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.066	Fig. legend	t=1.908	Fig. legend

+ -	7a	two-tailed unpaired t-test	Fig. legend	16,16	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.0001	Fig. legend	t=4.382	Fig. legend
+ -	7b	two-tailed unpaired t-test	Fig. legend	16,16	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.939	Fig. legend	t=0.082	Fig. legend
+ -	7b	two-tailed unpaired t-test	Fig. legend	16,16	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.428	Fig. legend	t=0.803	Fig. legend
+ -	7b	two-tailed unpaired t-test	Fig. legend	16,16	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.330	Fig. legend	t=0.990	Fig. legend
+ -	7c	two-way RM-ANOVA	Fig. legend	16,16	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p<0.0001	Fig. legend	F(1,30)=32.82	Fig. legend
+ -	7c	two-way RM-ANOVA	Fig. legend	16,16	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.022	Fig. legend	F(1,30)=7.364	Fig. legend
+ -	7c	two-tailed unpaired t-test	Fig. legend	16,16	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.009	Fig. legend	t=2.774	Fig. legend
+ -	7d	two-tailed unpaired t-test	Fig. legend	14,14	rats	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.0001	Fig. legend	t=3.70	Fig. legend
+ -	7d	two-tailed unpaired t-test	Fig. legend	14,14	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p<0.0001	Fig. legend	t=5.00	Fig. legend
+ -	7e	two-way RM-ANOVA	Fig. legend	14,14	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.0043	Fig. legend	F(1,26)=9.790	Fig. legend
+ -	7f	two-tailed unpaired t-test	Fig. legend	14,14	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.046	Fig. legend	t=2.090	Fig. legend
+ -	7f	two-way RM-ANOVA	Fig. legend	14,14	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.0088	Fig. legend	F(1,26)=8.022	Fig. legend
+ -	7g	Pearson r	Fig. legend	14,14	same rats as above	Fig. legend	individual data	Fig. legend	p<0.01	Fig. legend	R square=0.65	Fig. legend
+ -	7g	Pearson r	Fig. legend	14,14	same rats as above	Fig. legend	individual data	Fig. legend	p<0.01	Fig. legend	R square=0.54	Fig. legend
+ -	7g	Pearson r	Fig. legend	14,14	same rats as above	Fig. legend	individual data	Fig. legend	p>0.05	Fig. legend	R square=0.01	Fig. legend
+ -	7g	Pearson r	Fig. legend	14,14	same rats as above	Fig. legend	individual data	Fig. legend	p>0.05	Fig. legend	R square=0.10	Fig. legend
+ -	S9a	two-way RM-ANOVA	Fig. legend	14,14	rats	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.16	Fig. legend	F(1,26)=2.1	Fig. legend
+ -	S9a	two-tailed unpaired t-test	Fig. legend	14,14	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.679	Fig. legend	t=0.4186	Fig. legend
+ -	S9b	two-tailed unpaired t-test	Fig. legend	10,10	rats	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.51	Fig. legend	t=0.679	Fig. legend
+ -	S9c	two-tailed unpaired t-test	Fig. legend	10,10	rats	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.74	Fig. legend	t=0.338	Fig. legend
+ -	S9d	two-way RM-ANOVA	Fig. legend	8,8	rats	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.0008	Fig. legend	F(1,14)=18.290	Fig. legend
+ -	S9d	two-way RM-ANOVA	Fig. legend	8,8	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.046	Fig. legend	F(1,14)=4.791	Fig. legend
+ -	S9d	two-tailed unpaired t-test	Fig. legend	8,8	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.042	Fig. legend	t=2.237	Fig. legend
+ -	S9e	two-way RM-ANOVA	Fig. legend	6,7	rats	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.044	Fig. legend	F(1,11)=5.15	Fig. legend
+ -	S9f	two-way RM-ANOVA	Fig. legend	6,7	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.104	Fig. legend	F(1,11)=3.149	Fig. legend

+ -	S9g	two-way RM-ANOVA	Fig. legend	18,18	rats	Fig. legend	number of rats	Fig. legend	p=0.715	Fig. legend	F(1,34)=0.136	Fig. legend
+ -	S9h	two-way RM-ANOVA	Fig. legend	16,17	rats	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.46	Fig. legend	F(1,31)=0.563	Fig. legend
+ -	S9h	two-way RM-ANOVA	Fig. legend	16,17	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.786	Fig. legend	F(1,31)=0.075	Fig. legend
+ -	S9h	two-tailed unpaired t-test	Fig. legend	16,17	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p<0.0001	Fig. legend	t=5.582	Fig. legend
+ -	S9i	two-tailed unpaired t-test	Fig. legend	13,17	rats	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.685	Fig. legend	t=0.410	Fig. legend
+ -	S9i	two-tailed unpaired t-test	Fig. legend	13,17	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.336	Fig. legend	t=0.978	Fig. legend
+ -	8a	two-way RM-ANOVA	Fig. legend	5,6,6	rats	Fig. legend	mean ± 95% C.I.	Fig. legend	p<0.0001	Fig. legend	F(10,70)=8.11	Fig. legend
+ -	8b	one-way ANOVA	Fig. legend	5,6,6	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.0002	Fig. legend	F(2,15)=15.19	Fig. legend
+ -	8b	two-way RM-ANOVA	Fig. legend	5,6,6	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p<0.0001	Fig. legend	F(24,168)=3.098	Fig. legend
+ -	8c	one-way ANOVA	Fig. legend	5,5	rats	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.861	Fig. legend	F(5,40)=0.379	Fig. legend
+ -	8d	two-tailed unpaired t-test	Fig. legend	5,5	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.620	Fig. legend	t=0.516	Fig. legend
+ -	8d	two-way RM-ANOVA	Fig. legend	5,5	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.996	Fig. legend	F(12,96)=0.234	Fig. legend
+ -	8e	two-way RM-ANOVA	Fig. legend	7,6,6,6	rats	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.315	Fig. legend	F(3,21)=1.255	Fig. legend
+ -	8e	two-way RM-ANOVA	Fig. legend	7,6,6,6	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.597	Fig. legend	F(3,21)=0.641	Fig. legend
+ -												
+ -	S4a	two-way RM-ANOVA	Fig. legend	6,7	rats	Fig. legend	mean ± 95% C.I.	Fig. legend	p<0.0001	Fig. legend	F(1,11)=42.34	Fig. legend
+ -	S4a	two-way RM-ANOVA	Fig. legend	6,7	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p<0.0001	Fig. legend	F(1,11)=49.37	Fig. legend
+ -	S4b	two-way RM-ANOVA	Fig. legend	6,6,7	rats	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.096	Fig. legend	F(2,16)=2.71	Fig. legend
+ -	S4b	two-way RM-ANOVA	Fig. legend	6,6,7	same rats as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.386	Fig. legend	F(2,16)=1.011	Fig. legend
+ -	S6c	two-tailed unpaired t-test	Fig. legend	5,4	rats	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.0001	Fig. legend	t=7.828	Fig. legend
+ -	S6c	two-tailed unpaired t-test	Fig. legend	5,4	rats	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.0016	Fig. legend	t=4.982	Fig. legend
+ -	S7b	two-way RM-ANOVA	Fig. legend	16,11	neurons	Fig. legend	mean ± 95% C.I.	Fig. legend	p<0.0001	Fig. legend	F(78,1482)=1.770	Fig. legend
+ -	S7c	two-way RM-ANOVA	Fig. legend	16,11	neurons	Fig. legend	mean ± 95% C.I.	Fig. legend	p<0.0001	Fig. legend	F(4,125)=15.69	Fig. legend
+ -	S8a	two-tailed unpaired t-test	Fig. legend	14,19	neurons	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.177	Fig. legend	t=1.383	Fig. legend
+ -	S8b	two-tailed unpaired t-test	Fig. legend	14,19	same neurons as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.605	Fig. legend	t=0.522	Fig. legend
+ -	S8c	two-way RM-ANOVA	Fig. legend	14,14	neurons	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.615	Fig. legend	F(1,26)=0.260	Fig. legend
+ -	S8d	two-tailed unpaired t-test	Fig. legend	21,25	neurons	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.314	Fig. legend	t=1.019	Fig. legend

+ -	S8d	two-tailed unpaired t-test	Fig. legend	21,25	same neurons as above	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.483	Fig. legend	t=0.707	Fig. legend
+ -	S8e	two-tailed unpaired t-test	Fig. legend	17,20	neurons	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.0005	Fig. legend	t=3.818	Fig. legend
+ -	S8e	two-tailed unpaired t-test	Fig. legend	14,16	neurons	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.027	Fig. legend	t=2.336	Fig. legend
+ -	S10a	two-tailed Chi square	Fig. legend	16,16	rats	Fig. legend	number of rats	Fig. legend	p=0.0149	Fig. legend	chi square=5.926	Fig. legend
+ -	S10b	two-tailed Chi square	Fig. legend	10,10	pairs	Fig. legend	number of pairs	Fig. legend	p=0.0017	Fig. legend	chi square=9.899	Fig. legend
+ -	S10c	two-tailed unpaired t-test	Fig. legend	10,10	same pairs	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.001	Fig. legend	t=3.883	Fig. legend
+ -	S10c	two-tailed unpaired t-test	Fig. legend	10,10	same pairs	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.1696	Fig. legend	t=1.431	Fig. legend
+ -	S11c	two-way ANOVA	Fig. legend	30,24,19, 11	neurons	Fig. legend	mean ± 95% C.I.	Fig. legend	p=0.0021	Fig. legend	F(1,80)=10.14	Fig. legend
+ -	S11c	two-way ANOVA	Fig. legend	8,8,8,8	tracks	Fig. legend	mean ± 95% C.I.	Fig. legend	p<0.0001	Fig. legend	F(1,28)=22.21	Fig. legend
+ -												
+ -												

Representative figures

1. Are any representative images shown (including Western blots and immunohistochemistry/staining) in the paper?

   If so, what figure(s)?

   Yes.
   Figure 2a; Figure 4a; Supplementary Figure 5a, b

2. For each representative image, is there a clear statement of how many times this experiment was successfully repeated and a discussion of any limitations in repeatability?

   If so, where is this reported (section, paragraph #)?

   Yes.
   Only Supplementary Figure 5 is related to quantification. Indicated in Supplementary Figure 5 legend, and legends for any experiments with DREADD (Figures 2 and 4).

Statistics and general methods

1. Is there a justification of the sample size?

   If so, how was it justified?

   Where (section, paragraph #)?

   Even if no sample size calculation was performed, authors should report why the sample size is adequate to measure their effect size.

   Yes. Sample size was determined based on effect sizes from preliminary studies. This is indicated in Methods, Behavior (paragraph 1) and Methods, Electrophysiology (paragraph 1).

2. Are statistical tests justified as appropriate for every figure?

   Where (section, paragraph #)?

   Yes, Methods, Statistical analysis.

a. If there is a section summarizing the statistical methods in the methods, is the statistical test for each experiment clearly defined?

Yes.

b. Do the data meet the assumptions of the specific statistical test you chose (e.g. normality for a parametric test)?

Where is this described (section, paragraph #)?

Yes. Methods, Statistical analysis.

c. Is there any estimate of variance within each group of data?

Is the variance similar between groups that are being statistically compared?

Where is this described (section, paragraph #)?

Yes. Standard error is displayed on each plot (or Tukey distribution, SD, or 2x standard error, where noted). Data were tested for homogeneity of variance. Parametric statistics were used only when variance passed this test (Methods, Statistical analysis, paragraph 1).

d. Are tests specified as one- or two-sided?

Yes.

e. Are there adjustments for multiple comparisons?

Yes.

3. To promote transparency, *Nature Neuroscience* has stopped allowing bar graphs to report statistics in the papers it publishes. If you have bar graphs in your paper, please make sure to switch them to dot-plots (with central and dispersion statistics displayed) or to box-and-whisker plots to show data distributions.

Done.

4. Are criteria for excluding data points reported?

Was this criterion established prior to data collection?

Where is this described (section, paragraph #)?

Yes.
Methods, Behavior, Standard cued fear conditioning (last line).
Methods, Electrophysiology, In vivo electrophysiology (end of paragraph 2).

5. Define the method of randomization used to assign subjects (or samples) to the experimental groups and to collect and process data.

If no randomization was used, state so.

Where does this appear (section, paragraph #)?

Rats groups were run in parallel for the different experimental groups. Each cage (2-3/cage) was assigned to a different experimental group. The first cage was randomly assigned to a treatment group by chance procedure. The remaining cage was assigned to the remaining group.
Methods, Chemogenetic surgical procedure, paragraph 1

6. Is a statement of the extent to which investigator knew the group allocation during the experiment and in assessing outcome included?

If no blinding was done, state so.

Where (section, paragraph #)?

Yes.
Methods, Behavior, paragraph 1

7. For experiments in live vertebrates, is a statement of compliance with ethical guidelines/regulations included?

Where (section, paragraph #)?

Yes.
Methods, paragraph 1

8. Is the species of the animals used reported?

Where (section, paragraph #)?

Yes.
Methods, Animal model, paragraph 1

9. Is the strain of the animals (including background strains of KO/ transgenic animals used) reported? Where (section, paragraph #)?	Yes. Methods, Animal model, paragraph 1
10. Is the sex of the animals/subjects used reported? Where (section, paragraph #)?	Yes. Methods, Animal model, paragraph 1
11. Is the age of the animals/subjects reported? Where (section, paragraph #)?	Yes. Methods, Animal model, paragraph 1
12. For animals housed in a vivarium, is the light/dark cycle reported? Where (section, paragraph #)?	Yes. Methods, Animal model, paragraph 1
13. For animals housed in a vivarium, is the housing group (i.e. number of animals per cage) reported? Where (section, paragraph #)?	Yes. Methods, Animal model, paragraph 1
14. For behavioral experiments, is the time of day reported (e.g. light or dark cycle)? Where (section, paragraph #)?	Yes. Methods, Animal model, paragraph 1
15. Is the previous history of the animals/subjects (e.g. prior drug administration, surgery, behavioral testing) reported? Where (section, paragraph #)?	Yes. Methods, Animal model, paragraph 1
a. If multiple behavioral tests were conducted in the same group of animals, is this reported? Where (section, paragraph #)?	Yes. Methods, Behavior, paragraph 1
16. If any animals/subjects were excluded from analysis, is this reported? Where (section, paragraph #)?	Yes. Methods, Behavior, paragraph 1.
a. How were the criteria for exclusion defined? Where is this described (section, paragraph #)?	Equipment failure. Methods, Animal model, paragraph 1
b. Specify reasons for any discrepancy between the number of animals at the beginning and end of the study. Where is this described (section, paragraph #)?	NA

Reagents

1. Have antibodies been validated for use in the system under study (assay and species)?	Yes.
a. Is antibody catalog number given? Where does this appear (section, paragraph #)?	Yes. Methods, Validation of Neurexin-1α knockout in rats Methods, Chemogenetic surgical procedure
b. Where were the validation data reported (citation, supplementary information, Antibodypedia)? Where does this appear (section, paragraph #)?	Citation, bioz.org with links to citations, and distributor website or verification in knockouts (Supplementary Figure 5). Methods, Validation of Neurexin-1α knockout in rats Methods, Chemogenetic surgical procedure
2. Cell line identity a. Are any cell lines used in this paper listed in the database of commonly misidentified cell lines maintained by ICLAC and NCBI Biosample? Where (section, paragraph #)?	NA
b. If yes, include in the Methods section a scientific justification of their use--indicate here in which section and paragraph the justification can be found.	NA
c. For each cell line, include in the Methods section a statement that specifies: - the source of the cell lines - have the cell lines been authenticated? If so, by which method? - have the cell lines been tested for mycoplasma contamination? Where (section, paragraph #)?	NA

Data availability

Provide a Data availability statement in the Methods section under "Data availability", which should include, where applicable:

- Accession codes for deposited data
- Other unique identifiers (such as DOIs and hyperlinks for any other datasets)
- At a minimum, a statement confirming that all relevant data are available from the authors
- Formal citations of datasets that are assigned DOIs
- A statement regarding data available in the manuscript as source data
- A statement regarding data available with restrictions

See our data availability and data citations policy page for more information.

Data deposition in a public repository is mandatory for:

a. Protein, DNA and RNA sequences
b. Macromolecular structures
c. Crystallographic data for small molecules
d. Microarray data

Deposition is strongly recommended for many other datasets for which structured public repositories exist; more details on our data policy are available here. We encourage the provision of other source data in supplementary information or in unstructured repositories such as Figshare and Dryad.

We encourage publication of Data Descriptors (see Scientific Data) to maximize data reuse.

Where is the Data Availability statement provided (section, paragraph #)?

Data availability, paragraph 1.

Computer code/software

Any custom algorithm/software that is central to the methods must be supplied by the authors in a usable and readable form for readers at the time of publication. However, referees may ask for this information at any time during the review process.

1. Identify all custom software or scripts that were required to conduct the study and where in the procedures each was used.

NA

2. If computer code was used to generate results that are central to the paper's conclusions, include a statement in the Methods section under "**Code availability**" to indicate whether and how the code can be accessed. Include version information as necessary and any restrictions on availability.

NA

Human subjects

1. Which IRB approved the protocol?

   Where is this stated (section, paragraph #)?

   NA

2. Is demographic information on all subjects provided?

   Where (section, paragraph #)?

   NA

3. Is the number of human subjects, their age and sex clearly defined?

   Where (section, paragraph #)?

   NA

4. Are the inclusion and exclusion criteria (if any) clearly specified?

   Where (section, paragraph #)?

   NA

5. How well were the groups matched?

   Where is this information described (section, paragraph #)?

   NA

6. Is a statement included confirming that informed consent was obtained from all subjects?

   Where (section, paragraph #)?

   NA

7. For publication of patient photos, is a statement included confirming that consent to publish was obtained?

   Where (section, paragraph #)?

   NA

fMRI studies

For papers reporting functional imaging (fMRI) results please ensure that these minimal reporting guidelines are met and that all this information is clearly provided in the methods:

1. Were any subjects scanned but then rejected for the analysis after the data was collected?

   NA

   a. If yes, is the number rejected and reasons for rejection described?

      Where (section, paragraph #)?

      NA

2. Is the number of blocks, trials or experimental units per session and/or subjects specified?

   Where (section, paragraph #)?

   NA

3. Is the length of each trial and interval between trials specified?

   NA

4. Is a blocked, event-related, or mixed design being used? If applicable, please specify the block length or how the event-related or mixed design was optimized.

   NA

5. Is the task design clearly described? Where (section, paragraph #)?	NA
6. How was behavioral performance measured?	NA
7. Is an ANOVA or factorial design being used?	NA
8. For data acquisition, is a whole brain scan used? If not, state area of acquisition.	NA
a. How was this region determined?	NA
9. Is the field strength (in Tesla) of the MRI system stated?	NA
a. Is the pulse sequence type (gradient/spin echo, EPI/spiral) stated?	NA
b. Are the field-of-view, matrix size, slice thickness, and TE/TR/ flip angle clearly stated?	NA
10. Are the software and specific parameters (model/functions, smoothing kernel size if applicable, etc.) used for data processing and pre-processing clearly stated?	NA
11. Is the coordinate space for the anatomical/functional imaging data clearly defined as subject/native space or standardized stereotaxic space, e.g., original Talairach, MNI305, ICBM152, etc? Where (section, paragraph #)?	NA
12. If there was data normalization/standardization to a specific space template, are the type of transformation (linear vs. nonlinear) used and image types being transformed clearly described? Where (section, paragraph #)?	NA
13. How were anatomical locations determined, e.g., via an automated labeling algorithm (AAL), standardized coordinate database (Talairach daemon), probabilistic atlases, etc.?	NA
14. Were any additional regressors (behavioral covariates, motion etc) used?	NA
15. Is the contrast construction clearly defined?	NA
16. Is a mixed/random effects or fixed inference used?	NA
a. If fixed effects inference used, is this justified?	NA
17. Were repeated measures used (multiple measurements per subject)?	NA

a. If so, are the method to account for within subject correlation and the assumptions made about variance clearly stated?	NA
18. If the threshold used for inference and visualization in figures varies, is this clearly stated?	NA
19. Are statistical inferences corrected for multiple comparisons?	NA
a. If not, is this labeled as uncorrected?	NA
20. Are the results based on an ROI (region of interest) analysis?	NA
a. If so, is the rationale clearly described?	NA
b. How were the ROI's defined (functional vs anatomical localization)?	NA
21. Is there correction for multiple comparisons within each voxel?	NA
22. For cluster-wise significance, is the cluster-defining threshold and the corrected significance level defined?	NA

Additional comments

Additional Comments	