
Supplementary information

Intercalated amygdala clusters orchestrate a switch in fear state

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Supplementary Table 1 | Cross-study comparison of ITC cluster nomenclature.

References This study	Busti et al., 2011	Asede et al., 2015	Marowsky et al., 2005	Duvarci and Pare, 2014	Other widely used abbreviations
Dorsomedial (ITC _{dm})	Imp/lap/IMG	mplTC	medial pc	ICM _{MD}	mlTCd, mlTC mICN
Ventromedial (ITC _{vm})	(posterior part of) IN		(posterior part of) main	(posterior part of) ICM _{MV}	(posterior part of) mlTCv, Im, mainITC, main ICN
Anteroventral (ITC _{av})	(anterior part of) IN		(anterior part of) main	(anterior part of) ICM _{MV}	(anterior part of) mlTCv, Im, mainITC
Lateral (ITC _l)	llp		lateral pc	ICM _L	lICN
Apical (ITC _{ap})	ls _{LA}		dorsal pc		dICN
Internal (ITC _{int})	li _{LA}				
Posteroventral (ITC _{pv})					

Because different nomenclature and abbreviations were used for individual ITC clusters in previous work, here we organize them from representative references and summarize their correspondence to our definition used in this study. Of note, our detailed reconstructions led us to distinguish ITC_{vm} from a more rostrally located ventral cluster, which we label ITC anteroventral (ITC_{av}). Also, we report a new cluster – ITC posteroventral (ITC_{pv}), which has not been reported previously.

Supplementary Table 2

Summary of repeated measures ANOVA followed by Sidak post-hoc analysis for chemogenetic manipulation experiments.

Experiment		Fear conditioning		Extinction		Retrieval						
		<i>F</i> (<i>DFn</i> , <i>DFd</i>)	<i>P</i> value	<i>F</i> (<i>DFn</i> , <i>DFd</i>)	<i>P</i> value	<i>Cre</i> -	<i>n</i>	<i>Cre</i> +	<i>n</i>	<i>F</i> (<i>DFn</i> , <i>DFd</i>)	<i>P</i> value	Post-hoc <i>P</i> value
vmITC-KORD extinction	Interaction	<i>F</i> (3, 75) = 0.8528	<i>P</i> =0.4695	<i>F</i> (10, 250) = 0.6599	<i>P</i> =0.7611	22.5 ± 3.1	16	37.6 ± 5.2	11	<i>F</i> (1, 25) = 4.828	<i>P</i> =0.0375	Base 0.684
	Trials	<i>F</i> (3, 75) = 79.09	<i>P</i> <0.0001	<i>F</i> (10, 250) = 55.3	<i>P</i> <0.0001					<i>F</i> (1, 25) = 96.36	<i>P</i> <0.0001	CS 0.0013
	Group	<i>F</i> (1, 25) = 0.6231	<i>P</i> =0.4373	<i>F</i> (1, 25) = 0.0499	<i>P</i> =0.8251					<i>F</i> (1, 25) = 8.553	<i>P</i> =0.0072	
<i>bilateral</i>	Interaction	<i>F</i> (3, 54) = 0.3015	<i>P</i> =0.8241	<i>F</i> (10, 180) = 0.7671	<i>P</i> =0.6603			41.7 ± 13.1	4	<i>F</i> (1, 18) = 5.61	<i>P</i> =0.0293	
	Trials	<i>F</i> (3, 54) = 35.19	<i>P</i> <0.0001	<i>F</i> (10, 180) = 27.93	<i>P</i> <0.0001					<i>F</i> (1, 18) = 56.12	<i>P</i> <0.0001	
	Group	<i>F</i> (1, 18) = 0.0174	<i>P</i> =0.8965	<i>F</i> (1, 18) = 0.06043	<i>P</i> =0.8086					<i>F</i> (1, 18) = 4.088	<i>P</i> =0.0583	
<i>unilateral</i>	Interaction	<i>F</i> (3, 63) = 0.8277	<i>P</i> =0.4836	<i>F</i> (10, 210) = 0.5154	<i>P</i> =0.8783			35.2 ± 4.4	7	<i>F</i> (1, 21) = 2.651	<i>P</i> =0.1184	Base 0.3991
	Trials	<i>F</i> (3, 63) = 67.17	<i>P</i> <0.0001	<i>F</i> (10, 210) = 40.79	<i>P</i> <0.0001					<i>F</i> (1, 21) = 104.9	<i>P</i> <0.0001	CS 0.0059
	Group	<i>F</i> (1, 21) = 1.593	<i>P</i> =0.2208	<i>F</i> (1, 21) = 0.01253	<i>P</i> =0.9119					<i>F</i> (1, 21) = 7.384	<i>P</i> =0.0129	
vmITC-KORD retrieval	Interaction	<i>F</i> (3, 51) = 0.8326	<i>P</i> =0.4695	<i>F</i> (10, 170) = 0.5599	<i>P</i> =0.8448	27.3 ± 4.9	11	45.8 ± 2.7	8	<i>F</i> (1, 17) = 10.15	<i>P</i> =0.0054	Base 0.9478
	Trials	<i>F</i> (3, 51) = 79.81	<i>P</i> <0.0001	<i>F</i> (10, 170) = 22.9	<i>P</i> <0.0001					<i>F</i> (1, 17) = 151.5	<i>P</i> <0.0001	CS 0.0005
	Group	<i>F</i> (1, 17) = 0.3491	<i>P</i> =0.4373	<i>F</i> (1, 17) = 0.00388	<i>P</i> =0.9511					<i>F</i> (1, 17) = 7.407	<i>P</i> =0.0145	
<i>bilateral</i>	Interaction	<i>F</i> (3, 45) = 2.006	<i>P</i> =0.1266	<i>F</i> (10, 150) = 0.3327	<i>P</i> =0.9711			47.2 ± 2.8	6	<i>F</i> (1, 15) = 9.225	<i>P</i> =0.0083	Base 0.9653
	Trials	<i>F</i> (3, 45) = 66.54	<i>P</i> <0.0001	<i>F</i> (10, 150) = 19.2	<i>P</i> <0.0001					<i>F</i> (1, 15) = 121.8	<i>P</i> <0.0001	CS 0.001
	Group	<i>F</i> (1, 15) = 0.9281	<i>P</i> =0.3506	<i>F</i> (1, 15) = 1.446e-005	<i>P</i> =0.9970					<i>F</i> (1, 15) = 6.776	<i>P</i> =0.0200	
<i>unilateral</i>	Interaction	<i>F</i> (3, 33) = 0.6634	<i>P</i> =0.5805	<i>F</i> (10, 110) = 0.7059	<i>P</i> =0.7172			41.7 ± 8.3	2	<i>F</i> (1, 11) = 1.472	<i>P</i> =0.2504	
	Trials	<i>F</i> (3, 33) = 60.81	<i>P</i> <0.0001	<i>F</i> (10, 110) = 8.36	<i>P</i> <0.0001					<i>F</i> (1, 11) = 35.12	<i>P</i> <0.0001	
	Group	<i>F</i> (1, 11) = 0.5037	<i>P</i> =0.4927	<i>F</i> (1, 11) = 0.0177	<i>P</i> =0.8966					<i>F</i> (1, 11) = 1.248	<i>P</i> =0.2877	
vmITC-Gq-D retrieval	Interaction	<i>F</i> (3, 57) = 1.51	<i>P</i> =0.2217	<i>F</i> (2, 38) = 1.475	<i>P</i> =0.2415	57.3 ± 4.6	15	38.9 ± 6.1	6	<i>F</i> (1, 19) = 4.727	<i>P</i> =0.0425	Base 0.8994
	Trials	<i>F</i> (3, 57) = 68.81	<i>P</i> <0.0001	<i>F</i> (2, 38) = 160.2	<i>P</i> <0.0001					<i>F</i> (1, 19) = 149.9	<i>P</i> <0.0001	CS 0.0079
	Group	<i>F</i> (1, 19) = 1.641	<i>P</i> =0.2156	<i>F</i> (1, 19) = 0.0096	<i>P</i> =0.9230					<i>F</i> (1, 19) = 4.821	<i>P</i> =0.0407	
<i>bilateral</i>	Interaction	<i>F</i> (3, 48) = 0.5813	<i>P</i> =0.6302	<i>F</i> (3, 48) = 0.5813	<i>P</i> =0.6302			45.6 ± 8.9	3	<i>F</i> (1, 16) = 1.119	<i>P</i> =0.3058	
	Trials	<i>F</i> (3, 48) = 37.5	<i>P</i> <0.0001	<i>F</i> (3, 48) = 37.5	<i>P</i> <0.0001					<i>F</i> (1, 16) = 97.37	<i>P</i> <0.0001	
	Group	<i>F</i> (1, 16) = 0.6786	<i>P</i> =0.4222	<i>F</i> (1, 16) = 0.6786	<i>P</i> =0.4222					<i>F</i> (1, 16) = 1.049	<i>P</i> =0.3209	
<i>unilateral</i>	Interaction	<i>F</i> (3, 48) = 1.07	<i>P</i> =0.3707	<i>F</i> (2, 32) = 0.8408	<i>P</i> =0.4407			32.2 ± 7.8	3	<i>F</i> (1, 16) = 4.873	<i>P</i> =0.0422	Base 0.892
	Trials	<i>F</i> (3, 48) = 36.13	<i>P</i> <0.0001	<i>F</i> (2, 32) = 90.09	<i>P</i> <0.0001					<i>F</i> (1, 16) = 73.53	<i>P</i> <0.0001	CS 0.0073

	Group	F (1, 16) = 1.061	P=0.3183	F (1, 16) = 0.7701	P=0.3932					F (1, 16) = 5.09	P=0.0384	
dmITC-Gq-D retrieval	Interaction	F (3, 54) = 0.4647	P=0.7081	F (10, 180) = 0.6699	P=0.7514	28.5 ± 3.3	13	45.7 ± 7.6	7	F (1, 18) = 6.631	P=0.0191	Base 0.9849 CS 0.0044
	Trials	F (3, 54) = 84.85	P<0.0001	F (10, 180) = 64.94	P<0.0001					F (1, 18) = 112.3	P<0.0001	
	Group	F (1, 18) = 0.1635	P=0.6907	F (1, 18) = 1.042	P=0.3210					F (1, 18) = 4.737	P=0.0431	
<i>bilateral</i>	Interaction	F (3, 45) = 0.5395	P=0.6577	F (10, 150) = 0.6676	P=0.7531			51.3 ± 8.5	5	F (1, 15) = 6.28	P=0.0242	
	Trials	F (3, 45) = 67.3	P<0.0001	F (10, 150) = 39.1	P<0.0001					F (1, 15) = 92.19	P<0.0001	
	Group	F (1, 15) = 0.181	P=0.6766	F (1, 15) = 0.3969	P=0.5382					F (1, 15) = 4.101	P=0.0610	
<i>unilateral</i>	Interaction	F (3, 42) = 0.645	P=0.5905	F (10, 140) = 0.7389	P=0.6868			31.7 ± 15.0	2	F (1, 14) = 2.867	P=0.1126	
	Trials	F (3, 42) = 42.62	P<0.0001	F (10, 140) = 34.55	P<0.0001					F (1, 14) = 60.57	P<0.0001	
	Group	F (1, 14) = 2.117	P=0.1677	F (1, 14) = 0.7032	P=0.4158					F (1, 14) = 2.8	P=0.1164	
dmITC-KORD retrieval	Interaction	F (3, 72) = 0.1379	P=0.9370	F (2, 48) = 0.6476	P=0.5278	55.8 ± 4.2	15	30.9 ± 4.8	11	F (1, 24) = 15.28	P=0.0007	Base 0.8952 CS <0.0001
	Trials	F (3, 72) = 100.4	P<0.0001	F (2, 48) = 220.6	P<0.0001					F (1, 24) = 180.1	P<0.0001	
	Group	F (1, 24) = 0.6777	P=0.4185	F (1, 24) = 0.4069	P=0.5296					F (1, 24) = 12.28	P=0.0018	
<i>bilateral</i>	Interaction	F (3, 51) = 0.4864	P=0.6932	F (2, 34) = 2.621	P=0.0874			22.5 ± 7.3	4	F (1, 17) = 12.89	P=0.0023	Base 0.8888 CS <0.0001
	Trials	F (3, 51) = 37.9	P<0.0001	F (2, 34) = 99.77	P<0.0001					F (1, 17) = 70.84	P<0.0001	
	Group	F (1, 17) = 2.566	P=0.1276	F (1, 17) = 2.187	P=0.1575					F (1, 17) = 11.03	P=0.0040	
<i>unilateral</i>	Interaction	F (3, 60) = 0.1776	P=0.9112	F (2, 40) = 0.001963	P=0.9980			35.7 ± 5.9	7	F (1, 20) = 7.492	P=0.0127	Base 0.9557 CS 0.0018
	Trials	F (3, 60) = 86.85	P<0.0001	F (2, 40) = 195.3	P<0.0001					F (1, 20) = 148.1	P<0.0001	
	Group	F (1, 20) = 0.00021	P=0.9887	F (1, 20) = 0.0539	P=0.8188					F (1, 20) = 5.856	P=0.0252	
both ITC-KORD retrieval	Interaction	F (3, 78) = 0.8838	P=0.4533	F (10, 260) = 0.6105	P=0.8045	27.3 ± 2.7	17	46.4 ± 4.4	11	F (1, 26) = 11.86	P=0.0020	Base 0.688 CS <0.0001
	Trials	F (3, 78) = 102.3	P<0.0001	F (10, 260) = 58.16	P<0.0001					F (1, 26) = 195.7	P<0.0001	
	Group	F (1, 26) = 0.02319	P=0.8801	F (1, 26) = 0.06923	P=0.7945					F (1, 26) = 15.36	P=0.0006	
<i>bilateral</i>	Interaction	F (3, 63) = 0.2094	P=0.8895	F (10, 210) = 0.5152	P=0.8784			43.9 ± 7.7	6	F (1, 21) = 5.318	P=0.0314	Base 0.8511 CS 0.0022
	Trials	F (3, 63) = 68.77	P<0.0001	F (10, 210) = 37.58	P<0.0001					F (1, 21) = 107.8	P<0.0001	
	Group	F (1, 21) = 0.05664	P=0.8142	F (1, 21) = 0.03086	P=0.8622					F (1, 21) = 6.987	P=0.0152	
<i>unilateral</i>	Interaction	F (3, 60) = 1.18	P=0.3251	F (10, 200) = 0.721	P=0.7042			49.3 ± 3.2	5	F (1, 20) = 10.24	P=0.0045	Base 0.6621 CS <0.0001
	Trials	F (3, 60) = 53.83	P<0.0001	F (10, 200) = 32.47	P<0.0001					F (1, 20) = 137.2	P<0.0001	
	Group	F (1, 20) = 0.000214	P=0.9885	F (1, 20) = 0.05034	P=0.8247					F (1, 20) = 19.33	P=0.0003	

For each chemogenetic manipulation group mice with combined unilateral and bilateral, unilateral only and bilateral expression were compared using two-way ANOVA. Separate statistical analyses were conducted for each behavioral stage (fear conditioning, extinction, and retrieval). The F statistics for effects of each variable and interaction of variables are listed and sample size (n) for each group is provided. For retrieval data mean±SEM values are shown for Cre- and Cre+ mice. Post-hoc comparisons carried out using Sidak test are indicated as appropriate, separately for baseline and CS during retrieval. Statistical analyses were performed with an α level of 0.05. P values <0.05 were considered significant.