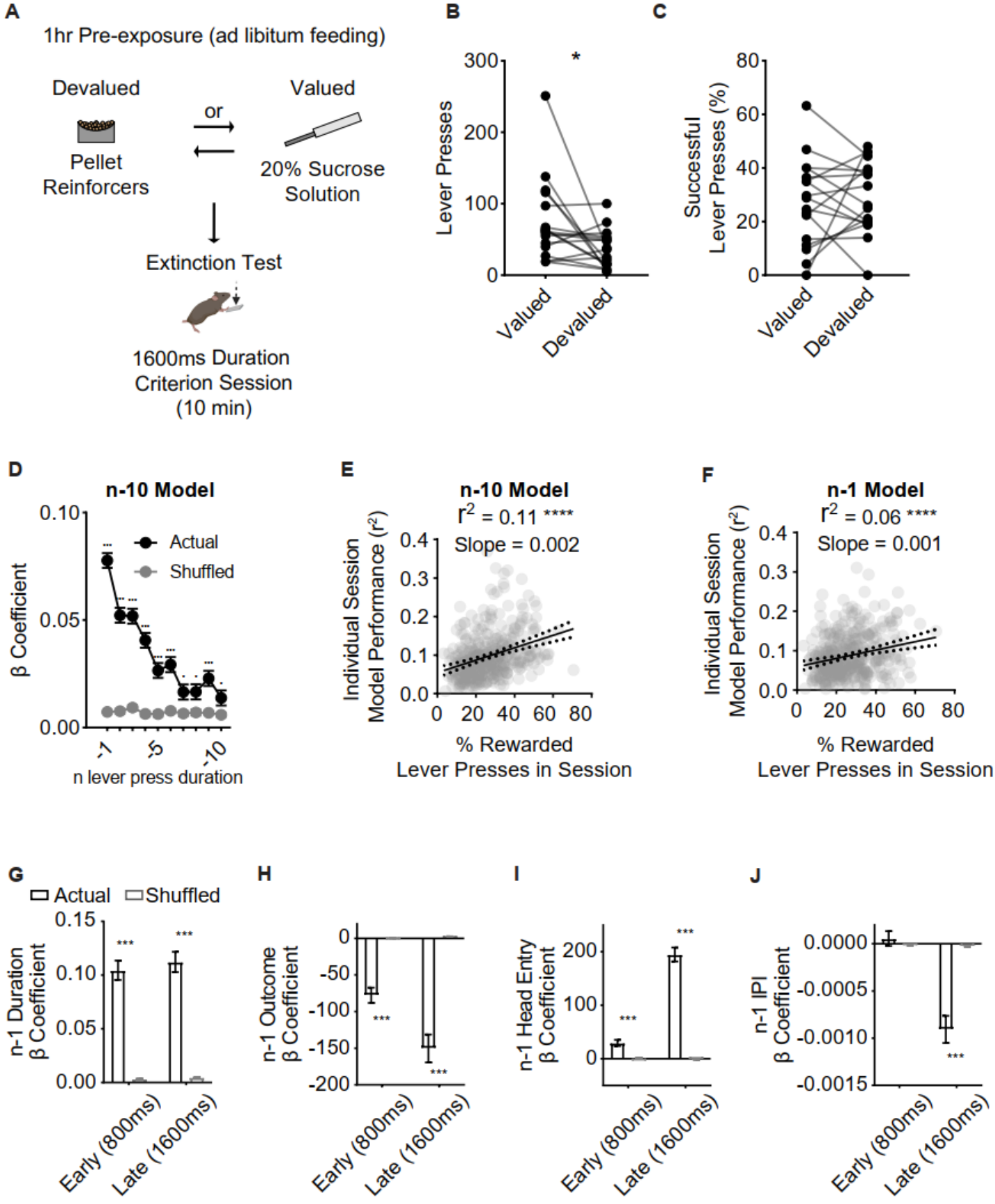

Figure S1. Devaluation testing procedures, performance, and LME models relating prior lever press durations to current press duration and overall session performance, related to Figure 1.

(A) Schematic showing counter-balanced devaluation testing procedures. Mice had 1 hour of free access to food pellets (devalued state) or a 20% sucrose solution (valued state) prior to a 10-minute 1600ms duration criterion session during which no reinforcers were delivered.
(B–C) Total lever presses (B) and percentage of lever presses (C) that exceeded the duration criterion in valued and devalued states throughout devaluation testing. Paired t tests revealed different patterns of lever pressing (t_{16} = 2.408, $p < 0.05$), but no difference in the percentage of lever presses (t_{16} = 0.3536, $p > 0.05$) that exceeded the duration criterion between valued and devalued states.
(D) β coefficients of LME model relating current lever press duration (n) to prior (n – 10) press durations for actual and order shuffled data.
(E) Linear regression for individual session data LME (n – 10) model described in (D), fitting (R^2) and percentage of lever presses that exceeded the duration criterion within that session. Dotted lines indicate 95% confidence interval of the best-fit line. Best-fit value slope = 0.001611 and Goodness of Fit (R^2) = 0.1120. Significant deviation from zero: $F_{1, 368}$ = 46.44, $p < 0.0001$.
(F) Linear regression for individual session data LME (n – 1) model described in (Fig. 1K–N), fitting (R^2) and percentage of lever presses that exceeded the duration criterion within that session. Dotted lines indicate 95% confidence interval of the best-fit line. Best-fit value slope = 0.001062 and Goodness of Fit (R^2) = 0.05838. Significant deviation from zero: $F_{1, 368}$ = 22.81, $p < 0.0001$.
(G–J) β coefficients of LME model relating current lever press duration (n) to prior (n – 1) press durations (G), press outcome (i.e. was lever press rewarded) (H), head entry (I), and interpress interval (IPI) (J) for actual and order shuffled data. Early 800 ms and Late 1600 ms refer to the first three days in which the duration criterion was >800 ms and the last two days in which the duration criterion >1600 ms, respectively.
Significance markers in (D) indicate comparisons to order shuffled data. Shuffled data are mean ± SEM of 1000 order shuffled β coefficients. * $p < 0.05$, *** $p < 0.001$, **** $p < 0.0001$.
See also Table S1 for more data.

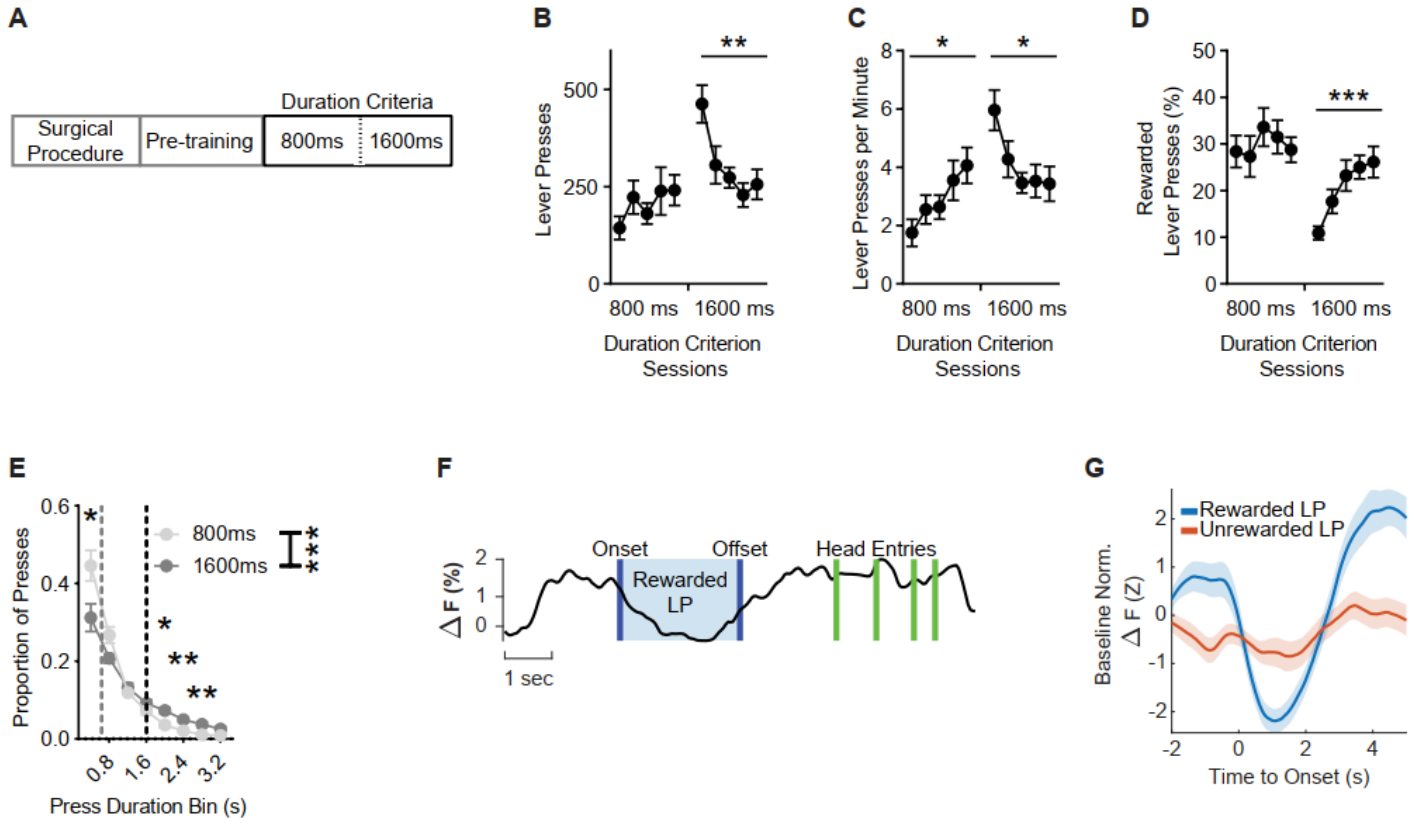

Figure S2. Lever press performance throughout acquisition for fiber photometry experiments and representative OFC$^{CamKII+}$ Ca^{2+} activity, related to Figure 2.

(A) Training schedule for the lever press hold down task during fiber photometry experiments. Pretraining sessions were followed by sessions with a minimum duration criterion.

(B–D) Total lever presses (B), (C) lever pressing rate and (D) percentage of lever presses that exceeded the duration criterion across sessions. One-way mixed effects RM ANOVAs revealed a differences across 1600 ms sessions for total lever presses ($F_{2.589, 41.43} = 5.739$, $p < 0.01$), lever pressing rate ($F_{2.652, 42.43} = 3.712$, $p < 0.05$), and percentage of lever presses that exceeded the duration criterion ($F_{2.959, 47.35} = 7.535$, $p < 0.001$). A Mixed-effects analysis revealed a difference across 800 ms sessions for lever pressing rate only ($F_{2.650, 41.74} = 3.000$, $p < 0.05$).

(E) Histogram of lever press durations (400 ms bins) averaged for 800 ms and 1600 ms duration criterion sessions. A two-way mixed effects RM ANOVA (Bin * Criteria) on the proportion of presses across duration bins between the two duration criteria revealed a significant interaction: $F_{1.894, 30.30} = 9.954$, $p < 00.001$, a main effect of Bin: $F_{1.351, 21.61} = 95.29$, $p < 0.0001$, and a main effect of Criteria: $F_{1, 16} = 10.65$, $p < 0.01$). Post hoc comparisons showed significant differences between the duration criteria within the 0.4 s ($p < 0.05$), 2.0 s ($p < 0.05$), 2.4 s ($p < 0.01$), 2.8 s ($p < 0.01$) duration bins.

(F) Representative trace showing the percentage of changes in baseline normalized Ca^{2+} activity over time. The region shaded in blue indicates a rewarded lever press duration. Green lines indicate head entries made.

(G) Representative Ca^{2+} activity from a 1600 ms duration criterion session aligned to lever press onset (i.e.

initiation). Activity is z-score normalized to a pre-lever press onset baseline period. Blue indicates trace average of rewarded lever presses. Orange indicates trace average of unrewarded lever presses.
LP = Lever Press. Data points represent mean ± SEM. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

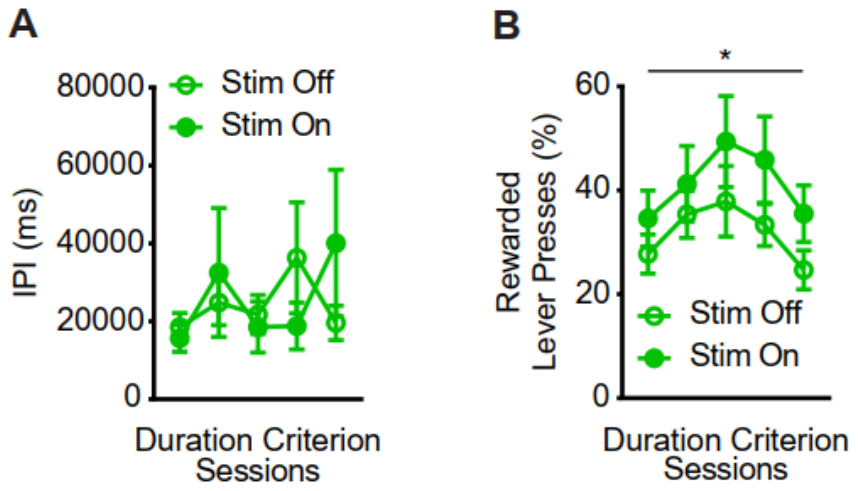

Figure S3. Activation of OFC$^{CamKII+}$ neurons did not change the time interval to initiate subsequent lever press nor rewarded performance, related to Figure 4.

(A) Interpress intervals from 1600 ms duration criterion sessions during which light was delivered on every 7th lever press, segmented by whether presses were paired with light activation or not (two-way RM ANOVA, no main effect of Stimulation $F_{1, 12} = 0.008$, $p = 0.93$ or Session $F_{4, 48} = 1.207$, $p = 0.40$).

(B) Percentage of lever presses that exceeded the duration criterion from 1600 ms duration criterion sessions during which light was delivered on every 7th lever press, segmented by whether presses were paired with light activation or not (two-way RM ANOVA, main effect of Session only $F_{4, 48} = 3.227$, $p = 0.02$).

Data points represent mean ± SEM. * $p < 0.05$

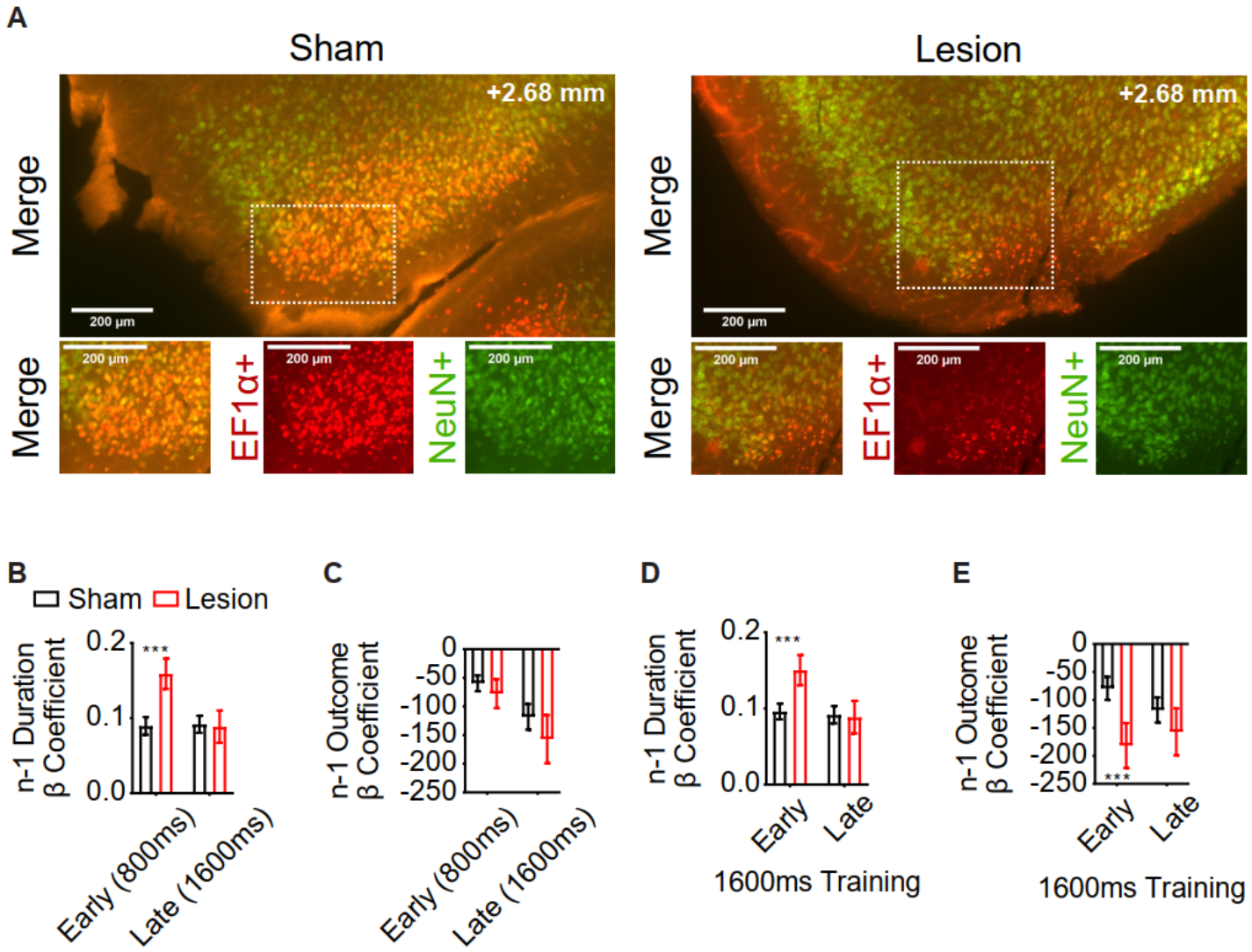

Figure S4. Representative histology of sham and Cre-dependent caspase lesions of OFC$^{CamKII+}$ neurons and effects of lesions on model coefficients across training, related to Figure 5.

(A) Representative histology as shown in (Figure 5A) of sham and Cre-dependent caspase lesions of lOFC neurons, zoomed in for visual clarity. Red indicates AAV-EF1α-DIO-mCherry expression. Green indicates immunohistochemical reactions for neural nuclear protein NeuN. White dotted squares indicate zoomed-in regions. Slice taken approximately from Bregma: AP +2.68mm, L +1.65mm and V −2.6mm.

(B and C) β coefficients of LME model relating current lever press duration (n) to prior (n - 1) press durations (B) and press outcome (i.e. was lever press rewarded) (C) for Sham and Lesion cohort actual data. Early 800 ms and Late 1600 ms refer to the first three days in which the duration criterion was >800 ms and the last two days in which the duration criterion was >1600 ms, respectively.

(D and E) β coefficients of LME model relating current lever press duration (n) to prior (n - 1) press durations (D) and press outcome (i.e. was lever press rewarded) (E) for Sham and Lesion cohort actual data. Early 1600 ms and Late 1600 ms refer to the first three days in which the duration criterion was >1600 ms and the last two days in which the duration criterion was >1600 ms, respectively.

Significance markers indicate comparisons to 1000 group shuffled data. Data points represent mean ± SEM. *** $p < 0.001$.

Table S1. Behavior LME Model Statistics, related to Figure 1 and Figure S1.

n - 1 LME Model Statistics							
Term	**Coef**	**SE**	**Upper**	**Lower**	**F-Stat**	**F-Pval**	**Perm P**
Intercept	314.8585	75.375065	462.59287	167.12412	17.449196	2.954E-05	N/A
On-1	-110.66545	7.4843838	-95.996128	-125.33476	218.63111	2.052E-49	**p < 0.001**
Dn-1	0.1179562	0.0046091	0.12699	0.1089225	654.95565	6.04E-144	**p < 0.001**
%Criteria	14.042042	0.3167509	14.662871	13.421213	1965.2812	0	**p < 0.001**
HEn-1	125.01432	4.8330364	134.48702	115.54162	669.08208	5.38E-147	**p < 0.001**
Ts	5.366E-05	1.612E-06	5.682E-05	5.05E-05	1108.161	1.57E-241	**p < 0.001**
IPIn-1	-0.0003987	5.602E-05	-0.0002888	-0.0005085	50.634357	1.121E-12	**p < 0.001**
n - 10 LME Model Statistics							
Term	**Coef**	**SE**	**Upper**	**Lower**	**F-Stat**	**F-Pval**	**Perm P**
Intercept	256.43136	57.342813	368.82276	144.03997	19.997895	7.762E-06	N/A
Dn-1	0.077146	0.0033899	0.0837902	0.0705019	517.90671	2.59E-114	**p < 0.01**
Dn-2	0.0516059	0.0034118	0.058293	0.0449188	228.7864	1.274E-51	**p < 0.01**
Dn-3	0.0527951	0.0034231	0.0595043	0.0460858	237.87327	1.345E-53	**p < 0.01**
Dn-4	0.0408967	0.0034323	0.047624	0.0341693	141.96957	1.046E-32	**p < 0.01**
Dn-5	0.0259445	0.0034392	0.0326854	0.0192037	56.908314	4.61E-14	**p < 0.01**
Dn-6	0.0293307	0.0034454	0.0360836	0.0225778	72.471728	1.721E-17	**p < 0.01**
Dn-7	0.0165319	0.0034511	0.0232961	0.0097677	22.946572	1.668E-06	**p = 0.03**
Dn-8	0.0160076	0.0034534	0.0227762	0.0092391	21.486694	3.568E-06	**p = 0.01**
Dn-9	0.0233749	0.0034577	0.030152	0.0165978	45.700008	1.387E-11	**p < 0.01**
Dn-10	0.0132799	0.0034536	0.0200489	0.0065108	14.785647	0.0001205	**p = 0.02**
%Criteria	10.679852	0.3384171	11.343147	10.016558	995.9236	2.28E-217	**p < 0.01**
Ts	3.288E-05	1.669E-06	3.615E-05	2.961E-05	388.16055	3.197E-86	**p < 0.01**
n - 1 Interactions LME Model Statistics							
Term	**Coef**	**SE**	**Upper**	**Lower**	**F-Stat**	**F-Pval**	**Perm P**
Intercept	335.25079	74.460159	481.19196	189.30963	20.271772	6.73E-06	N/A
On-1	-136.98086	11.867438	-113.72081	-160.24092	133.23119	8.45E-31	N/A
Dn-1	0.0853273	0.0067159	0.0984903	0.0721643	161.42588	5.94E-37	N/A
%Criteria	14.10931	0.3168733	14.730378	13.488241	1982.6228	0	N/A
HEn-1	51.356376	7.7364406	66.519722	36.19303	44.066276	3.19E-11	N/A
Ts	5.41E-05	1.61E-06	5.73E-05	5.09E-05	1127.7028	1.00E-245	N/A
IPIn-1	5.57E-05	9.03E-05	0.0002326	-0.0001213	0.3801208	0.5375401	N/A
On-1 * Dn-1	0.0059397	0.0086302	0.0228548	-0.0109754	0.473677	0.4913022	**p = 0.69**
HEn-1 * Dn-1	0.0893464	0.0072528	0.1035619	0.075131	151.75403	7.64E-35	**p < 0.01**
IPIn-1 * Dn-1	-4.60E-07	6.69E-08	-3.29E-07	-5.91E-07	47.33278	6.03E-12	**p < 0.01**

Parameters, their coefficients, and statistical tests for LME models predicting n duration given prior behavior. Degrees of Freedom for all (top) F-tests = 1, 91286, (middle) F-tests = 1, 87950, (bottom) F-tests = 1, 91283. On-1 = Outcome of prior lever press as binary 1 for rewarded and 0 for unrewarded. Dn-x = Duration of x prior lever press in ms. %Criteria = Percentage of lever presses in session that exceeded duration criterion. HEn-1 =

Headentry between current and prior lever press as binary 1 for head entry present and 0 for head entry absent. Ts = Lever press session timestamp in ms. IPI_{n-1} = time in ms between prior and current lever press. Data presented as regression coefficient variables that indicate their contribution in predicting current lever press duration changes given their occurrence. Data presented as two multiplied variables indicate the interaction with D_{n-1} and shows how the contribution of prior lever press duration in predicting current lever press duration changes given that variable.

Coef = β Coefficient. SE = Standard Error. Upper and Lower = 95% confidence intervals. F-stat = F-statistic. F-Pval = p-value from the F-test. Perm P = p-value from permutation test comparing to 1000 order shuffled (top) or 100 order shuffled (middle and bottom) β coefficients. P-values of 0 are reported for some terms due to Matlab's numerical resolution.

Table S2. OFC$^{CamKII+}$ Activity LME Model Statistics, related to Figure 2.

	Before Press, df = 15225			
Term	**Coef**	**F**	**F-Pval**	**Perm P**
Intercept	-4.8539932	1.4322664	0.2314135	N/A
Dn-0	0.0009882	3.9766795	**0.0461522**	**p = 0.009**
Dn-1	6.914E-05	0.0341399	0.853412	p = 0.846
IPIn-1	6.418E-05	42.490124	**7.327E-11**	N/A
On-1	-12.525499	48.024991	**4.377E-12**	N/A
HEn-1	19.514045	166.83156	**5.763E-38**	N/A
Ts	1.865E-06	24.689444	**6.808E-07**	N/A
AUCn-1	0.3115896	1656.0424	**0**	N/A

	During Press, df = 15146			
Term	**Coef**	**F**	**F-Pval**	**Perm P**
Intercept	-1.426484	1.1669784	0.2800402	N/A
Dn-0	-1.06E-03	49.433901	**2.14E-12**	**p < 0.001**
Dn-1	5.01E-04	19.450976	**1.04E-05**	**p < 0.001**
IPIn-1	1.92E-05	41.2402	**1.39E-10**	N/A
On-1	-1.06E+00	3.7458827	0.0529563	N/A
HEn-1	3.54E+00	59.665488	**1.19E-14**	N/A
Ts	7.80E-07	46.406142	**9.97E-12**	N/A
AUCn-1	3.39E-01	1976.8657	**0**	N/A

	After Press, df = 15225			
Term	**Coef**	**F**	**F-Pval**	**Perm P**
Intercept	-2.5717668	0.1447539	0.7036053	N/A
Dn-0	1.61E-02	95.102603	**2.10E-22**	**p < 0.001**
Dn-1	8.33E-03	44.138628	**3.16E-11**	**p < 0.001**
IPIn-1	4.08E-05	1.5410547	0.21448	N/A
On-1	-2.86E+01	22.480695	**2.14E-06**	N/A
HEn-1	-2.94E+01	33.454249	**7.44E-09**	N/A
Ts	4.48E-06	13.466452	**0.0002437**	N/A
AUCn-1	3.84E-01	2652.6839	**0**	N/A

Parameters, their coefficients, and statistical tests relating CamKII+ OFC calcium activity to behavior. We predicted activity at three different epochs relative to the lever press: -1s to 0s before lever press initiation, during the lever press, and 0s to +5s after lever press termination. Dn-0 = Duration of current lever press in ms. Dn-1 = Duration of prior lever press in ms. On-1 = Outcome of prior lever press as binary 1 for rewarded and 0 for unrewarded. HEn-1 = Headentry between current and prior lever press as binary 1 for head entry present and 0 for head entry absent. Ts = Lever press session timestamp in ms. IPIn-1 = time in ms between prior and current lever press.

We included prior activity (AUCn-1) as a covariate to control for autocorrelation in calcium activity signal. Data presented as regression coefficient variables that indicate their contribution in predicting current activity changes given their occurrence. Bolded terms indicate significance in the model by F-test.
Coef = β Coefficient. F-Pval = p-value from the F-test. Perm P = p-value from permutation test comparing to 1000 order shuffled β coefficients. P-values of 0 are reported for some terms due to Matlab's numerical resolution.

Table S3. OFC^{PV+} Activity LME Model Statistics, related to Figure 2.

	Before Press, df = 9586			
Term	**Coef**	**F**	**F-Pval**	**Perm P**
Intercept	-2.822237291	0.479099992	0.488847031	N/A
Dn-0	6.58E-05	0.017171255	0.895747099	p = 0.885
Dn-1	0.00068703	1.96485418	0.1610275	p = 0.155
IPIn-1	8.04E-07	0.005635457	0.940160836	N/A
On-1	4.346777874	4.985793376	**0.025579259**	N/A
HEn-1	0.358177489	0.050383202	0.822402594	N/A
Ts	-8.81E-08	0.046939823	0.82848105	N/A
AUCn-1	0.433348986	2216.289164	0	N/A

	During Press, df = 6972			
Term	**Coef**	**F**	**F-Pval**	**Perm P**
Intercept	-1.254393297	0.734170862	0.391564031	N/A
Dn-0	9.49E-05	0.305502025	5.80E-01	p = 0.551
Dn-1	6.99E-05	0.174332074	6.76E-01	p = 0.639
IPIn-1	-2.56E-06	0.491696991	4.83E-01	N/A
On-1	1.62E+00	5.938638458	**0.014837301**	N/A
HEn-1	1.05E+00	3.563447132	5.91E-02	N/A
Ts	2.08E-08	0.015701231	9.00E-01	N/A
AUCn-1	1.96E-01	278.0836691	2.98E-61	N/A

	After Press, df = 9586			
Term	**Coef**	**F**	**F-Pval**	**Perm P**
Intercept	8.277871193	0.922054651	0.336960285	N/A
Dn-0	8.29E-03	28.07694468	**1.19E-07**	p = 0.691
Dn-1	4.44E-04	0.084562547	7.71E-01	**p < 0.001**
IPIn-1	-3.03E-05	0.822718728	0.36440927	N/A
On-1	3.37E+01	30.90719611	**2.78E-08**	N/A
HEn-1	-4.21E+01	70.43578476	**5.43E-17**	N/A
Ts	1.54E-06	1.481249398	0.223609106	N/A
AUCn-1	3.65E-01	1441.454589	**5.71E-294**	N/A

Parameters, their coefficients, and statistical tests relating PV+ OFC calcium activity to behavior. We predicted activity at three different epochs relative to the lever press: -1s to 0s before lever press initiation, during the lever press, and 0s to +5s after lever press termination. Dn-0 = Duration of current lever press in ms. Dn-1 = Duration of prior lever press in ms. On-1 = Outcome of prior lever press as binary 1 for rewarded and 0 for unrewarded. HEn-1 = Headentry between current and prior lever press as binary 1 for head entry present and 0 for head entry absent. Ts = Lever press session timestamp in ms. IPIn-1 = time in ms between prior and current lever press.

We included prior activity (AUCn-1) as a covariate to control for autocorrelation in calcium activity signal. Data presented as regression coefficient variables that indicate their contribution in predicting current activity changes given their occurrence. Bolded terms indicate significance in the model by F-test.
Coef = β Coefficient. F-Pval = p-value from the F-test. Perm P = p-value from permutation test comparing to 1000 order shuffled β coefficients.

Table S4. OFC^{PV+} Activation Treatment Group LME Model Statistics, related to Figure 3.

Term	Coef	SE	Upper	Lower	F-Stat	F-Pval	Perm P
Intercept	294.80624	66.96325	426.06986	163.54261	19.38208	**1.08E-05**	N/A
On-1	-158.34336	68.28033	-24.49795	-292.18878	5.37785	**2.04E-02**	N/A
Dn-1	0.08201	0.02407	0.12919	0.03483	11.60913	**6.59E-04**	N/A
%Criteria	26.34108	1.99946	30.26050	22.42166	173.55614	**2.91E-39**	N/A
HEn-1	-43.47924	51.17692	56.83949	-143.79797	0.72180	**3.96E-01**	N/A
Ts	0.00005	0.00001	0.00007	0.00004	45.91469	**1.31E-11**	N/A
IPIn-1	0.00016	0.00021	0.00058	-0.00026	0.55811	0.4550441	N/A
Treatment	38.18195	53.53097	143.11517	-66.75127	0.50875	0.4756986	N/A
On-1 * Treatment	13.69072	91.86767	193.77284	-166.39139	0.02221	0.8815361	p = 0.803
Dn-1 * Treatment	-0.07428	0.03290	-0.00979	-0.13878	5.09802	**0.0239776**	**p = 0.006**
HEn-1 * Treatment	130.74381	68.35552	264.73661	-3.24900	3.65843	0.0558185	**p = 0.01**
IPIn-1 * Treatment	-0.00043	0.00030	0.00017	-0.00102	1.95460	0.1621277	p = 0.118

Parameters, their coefficients, and statistical tests for LME model predicting n duration given prior behavior. Degrees of Freedom for all F-tests = 1, 8793. On-1 = Outcome of prior lever press as binary 1 for rewarded and 0 for unrewarded. Dn-1 = Duration of prior lever press in ms. %Criteria = Percentage of lever presses in session that exceeded duration criterion. HEn-1 = Headentry between current and prior lever press as binary 1 for head entry present and 0 for head entry absent. Ts = Lever press session timestamp in ms. IPIn-1 = time in ms between prior and current lever press. Treatment = Presence of excitatory opsin ChR2 as binary 1 for present and 0 for absent.

Data presented as two multiplied variables indicate the effect if they occur in ChR2 mice (e.g., the interaction between Dn-1 * Treatment shows how the contribution of prior lever press duration in predicting current lever press duration changes given presence of ChR2.

Coef = β Coefficient. SE = Standard Error. Upper and Lower = 95% confidence intervals. F-stat = F-statistic. F-Pval = p-value from the F-test. Perm P = p-value from permutation test comparing to 1000 order shuffled β coefficients.

Table S5. OFC$^{CamKII+}$ Activation Treatment Group LME Model Statistics, related to Figure 4.

n -1 Treatment Interaction LME Model Statistics							
Term	**Coef**	**SE**	**Upper**	**Lower**	**F-Stat**	**F-Pval**	**Perm P**
Intercept	371.7199	65.0241	499.1803	244.2595	32.6801	**1.12E-08**	N/A
On-1	-68.4277	71.8824	72.4764	-209.3318	0.9062	**3.41E-01**	N/A
Dn-1	0.0751	0.0231	0.1204	0.0297	10.5282	**1.18E-03**	N/A
%Criteria	26.5936	1.4276	29.3920	23.7952	347.0053	**3.74E-76**	N/A
HEn-1	-54.2107	53.5572	50.7723	-159.1938	1.0246	**3.11E-01**	N/A
Ts	0.0001	0.0000	0.0001	0.0000	46.3795	**1.03E-11**	N/A
IPIn-1	-0.0003	0.0002	0.0001	-0.0006	1.8466	0.174204	N/A
Treatment	-139.1133	63.6851	-14.2776	-263.9490	4.7716	**0.028957**	N/A
On-1 * Treatment	-171.2101	88.1492	1.5802	-344.0004	3.7724	**0.052132**	**p = 0.001**
Dn-1 * Treatment	0.0863	0.0299	0.1449	0.0277	8.3388	**0.003889**	**p = 0.001**
HEn-1 * Treatment	213.2290	67.3024	345.1554	81.3025	10.0376	**0.001538**	**p < 0.001**
IPIn-1 * Treatment	0.0000	0.0003	0.0006	-0.0006	0.0002	0.988174	p = 0.989
ChR2 Mice Only: n -1 Activation Interaction LME Model Statistics							
Term	**Coef**	**SE**	**Upper**	**Lower**	**F-Stat**	**F-Pval**	**Perm P**
Intercept	164.6687	60.49933	283.2681	46.06925	7.408338	**0.00651**	N/A
On-1	-371.315	71.01612	-232.099	-510.531	27.33825	**1.76E-07**	N/A
Dn-1	0.124286	0.033771	0.19049	0.058082	13.54388	**0.000235**	N/A
%Criteria	27.05511	1.525669	30.04594	24.06428	314.469	**1.08E-68**	N/A
HEn-1	153.9502	63.7735	278.9682	28.93232	5.827472	**0.015806**	N/A
Ts	9.94E-05	1.27E-05	0.000124	7.46E-05	61.69031	**4.7E-15**	N/A
IPIn-1	0.000224	0.000419	0.001044	-0.0006	0.285319	0.593255	N/A
Stimn-0	253.9721	58.90581	369.4477	138.4965	18.58899	**1.65E-05**	N/A
Stimn-1	23.33592	60.98068	142.8789	-96.2071	0.146442	0.701972	N/A
Dn-1 * On-1	0.092325	0.039999	0.170738	0.013913	5.327664	**0.021022**	N/A
Dn-1 * HEn-1	0.013083	0.032578	0.076947	-0.05078	0.16127	0.688004	N/A
Dn-1 * IPIn-1	-5.4E-07	2.06E-07	-1.4E-07	-9.5E-07	6.974631	**0.008288**	N/A
Dn-1 * Stimn-0	-0.00982	0.034645	0.058093	-0.07774	0.080375	0.7768	N/A
IPIn-1 * Stimn-0	0.001341	0.000744	0.0028	-0.00012	3.245466	0.071669	N/A
Dn-1 * Stimn-1	-0.07602	0.031821	-0.01364	-0.1384	5.706848	**0.016928**	N/A
IPIn-1 * Stimn-1	-0.00026	0.000634	0.000982	-0.0015	0.168666	0.681314	N/A
YFP Mice Only: n -1 Activation Interaction LME Model Statistics							
Term	**Coef**	**SE**	**Upper**	**Lower**	**F-Stat**	**F-Pval**	**Perm P**
'(Intercept)'	483.75934	114.51877	708.28646	259.23223	17.844541	**2.46E-05**	N/A
On-1	-68.640362	107.18101	141.50024	-278.78097	0.4101318	0.5219428	N/A
Dn-1	0.0862542	0.0533197	0.1907935	-0.0182852	2.6168871	0.1058181	N/A
%Criteria	23.272496	3.0809257	29.313002	17.231989	57.058909	**5.31E-14**	N/A
HEn-1	54.43965	88.774153	228.49151	-119.61221	0.3760604	0.5397574	N/A
Ts	2.73E-05	1.43E-05	5.52E-05	-6.55E-07	3.6660641	0.0556093	N/A

IPIn-1	-3.35E-05	0.000382	0.0007155	-0.0007824	0.0076729	0.9302032	N/A
Stimn-0	164.82679	84.8703	331.2247	-1.5711238	3.7717605	0.0522016	N/A
Stimn-1	120.283	87.109118	291.07037	-50.504366	1.9066952	0.1674154	N/A
Dn-1 * On-1	0.0260959	0.0606194	0.1449473	-0.0927554	0.18532	0.6668661	N/A
Dn-1 * HEn-1	-0.0676451	0.041791	0.014291	-0.1495811	2.620033	0.1056086	N/A
Dn-1 * IPIn-1	-1.44E-07	2.39E-07	3.24E-07	-6.13E-07	0.3641353	0.546256	N/A
Dn-1 * Stimn-0	-0.0216541	0.0494551	0.0753083	-0.1186164	0.1917152	0.6615188	N/A
IPIn-1 * Stimn-0	-8.17E-05	0.0004492	0.0007991	-0.0009625	0.0331018	0.8556407	N/A
Dn-1 * Stimn-1	-0.0887973	0.0465705	0.0025094	-0.180104	3.6356161	0.0566341	N/A
IPIn-1 * Stimn-1	6.10E-05	0.0007855	0.0016011	-0.0014791	0.00603	0.9381083	N/A

Parameters, their coefficients, and statistical tests for LME models predicting n duration given prior behavior. Degrees of Freedom for all (top) F-tests = 1, 9936 (middle) F-tests = 1, 6266, (bottom) F-tests = 1, 3650. O_{n-1} = Outcome of prior lever press as binary 1 for rewarded and 0 for unrewarded. D_{n-1} = Duration of prior lever press in ms. %Criteria = Percentage of lever presses in session that exceeded duration criterion. HE_{n-1} = Headentry between current and prior lever press as binary 1 for head entry present and 0 for head entry absent. Ts = Lever press session timestamp in ms. IPI_{n-1} = time in ms between prior and current lever press. Treatment = Presence of excitatory opsin ChR2 as binary 1 for present and 0 for absent. Stimn-0 = Light stimulation during current lever press as binary 1 for light-on and 0 for light-off. Stimn-1 = Light stimulation during prior lever press as binary 1 for light-on and 0 for light-off.

For Treatment LME model (top), data presented as two multiplied variables indicate the effect if they occur in ChR2 mice (e.g., the interaction between D_{n-1} * Treatment shows how the contribution of prior lever press duration in predicting current lever press duration changes given presence of ChR2.

For Stimulation LME models (middle and bottom), data presented as two multiplied variables also indicate the effect if they occur in current (n-0) or prior (n-1) lever presses (e.g., the interaction between Dn-1 * Stimn-0 shows how the contribution of prior lever press duration in predicting current lever press duration changes given presence of light stimulation.

Coef = β Coefficient. SE = Standard Error. Upper and Lower = 95% confidence intervals. F-stat = F-statistic. F-Pval = p-value from the F-test. Perm P = p-value from permutation test comparing to 1000 order shuffled β coefficients.

Table S6. OFC$^{CamKII+}$ Lesion Treatment Group LME Model Statistics, related to Figure 5.

Term	Coef	SE	Upper	Lower	F-Stat	F-Pval	Perm P
'(Intercept)'	331.88952	69.65927	468.42071	195.35833	22.70018	**1.90E-06**	N/A
On-1	-86.11355	8.92831	-68.61418	-103.61292	93.02594	**5.27E-22**	N/A
Dn-1	0.10801	0.00531	0.11841	0.09761	414.43529	**5.91E-92**	N/A
%Criteria	14.03897	0.25970	14.54798	13.52996	2922.27079	**0.00E+00**	N/A
HEn-1	81.63634	5.57521	92.56368	70.70900	214.40969	**1.67E-48**	N/A
Ts	0.00004	0.00000	0.00005	0.00004	887.46022	**3.21E-194**	N/A
IPIn-1	0.00000	0.00006	0.00012	-0.00013	0.00370	0.9515054	N/A
Treatment	12.87046	17.96350	48.07867	-22.33775	0.51334	0.4736976	N/A
On-1 * Treatment	-47.03541	13.57523	-20.42815	-73.64268	12.00481	**0.0005308**	**p < 0.001**
Dn-1 * Treatment	0.03874	0.00758	0.05360	0.02388	26.12031	**3.21E-07**	**p < 0.001**
HEn-1 * Treatment	-4.66682	9.16477	13.29601	-22.62964	0.25930	0.6106043	p = 0576
IPIn-1 * Treatment	0.00008	0.00010	0.00027	-0.00011	0.65884	0.4169703	p = 0.446

Parameters, their coefficients, and statistical tests for LME model predicting n duration given prior behavior. Degrees of Freedom for all F-tests = 1, 108014. O_{n-1} = Outcome of prior lever press as binary 1 for rewarded and 0 for unrewarded. D_{n-1} = Duration of prior lever press in ms. %Criteria = Percentage of lever presses in session that exceeded duration criterion. HE_{n-1} = Headentry between current and prior lever press as binary 1 for head entry present and 0 for head entry absent. Ts = Lever press session timestamp in ms. IPI_{n-1} = time in ms between prior and current lever press. Treatment = Presence of caspase Lesion as binary 1 for present and 0 for absent.

Data presented as two multiplied variables indicate the effect if they occur in Lesioned mice (e.g., the interaction between D_{n-1} * Treatment shows how the contribution of prior lever press duration in predicting current lever press duration changes given presence of caspase Lesion.

Coef = β Coefficient. SE = Standard Error. Upper and Lower = 95% confidence intervals. F-stat = F-statistic. F-Pval = p-value from the F-test. Perm P = p-value from permutation test comparing to 1000 order shuffled β coefficients.