

Supplementary Information

Video Legends

Video 1. Representative defensive and predatory behaviors of mice towards a cockroach.

Video 2. Representative defensive and predatory behaviors of *Gad2::Cre* mice implanted with microendoscope in LHA.

Video 3. Representative predatory behaviors induced by LHA *Gad2+* neuron stimulation.

Video 4. Representative effect of LHA *Gad2+* neuron stimulation in the feeding test.

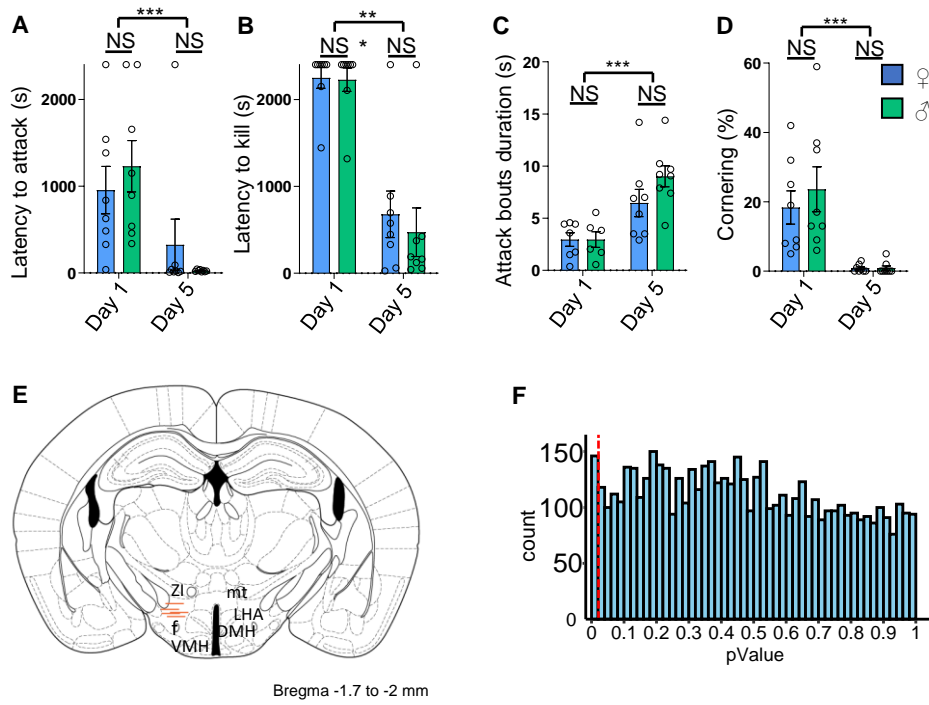
Supplementary Figure Legends

Figure S1. (A) Latency to attack a cockroach for female and male mice on day 1 and 5 of predation training (sex factor: $F[1, 28] = 0.00231$, $P = 0.96$; day factor: $F[1, 28] = 13.4$, $P = 0.0010$). (B) Latency to attack a cockroach (sex factor: $F[1, 28] = 0.18$, $P = 0.66$; day factor $F[1, 28] = 60.8$, $P < 0.0001$). (C) Predatory bout mean duration (sex factor: $F[1, 25] = 1.58$, $P = 0.220$; day factor: $F[1, 25] = 21.9$, $P < 0.0001$). (D) Time spent cornering during the first 20 min of test (sex factor: $F[1, 28] = 0.430$, $P = 0.518$; day factor: $F[1, 28] = 24.8$, $P < 0.0001$). (E) Schematic of GRIN lens placements in LHA. LHA: *lateral hypothalamus*, f: *fornix*, mt: *mamillary tract*, ZI: *zona incerta*, VMH: *ventromedial hypothalamus*, DMH: *dorsomedial hypothalamus*. (F) Histogram of the P-values obtained in a bootstrap test. The positions of the attack events in each recording were scrambled and the P-value of the change in activity at the randomized events calculated for each neuron. The process was repeated 100 times. The 100 P-values of each neuron are reported in the histogram. The vertical red dashed line represents the $P = 0.02$ cutoff (female: $N = 8$, male: $N = 8$ [except in C, day 1 – female: $N = 7$, male, $N = 6$]; two-way ANOVA sex-by-day with Bonferroni *post hoc* test; * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$).

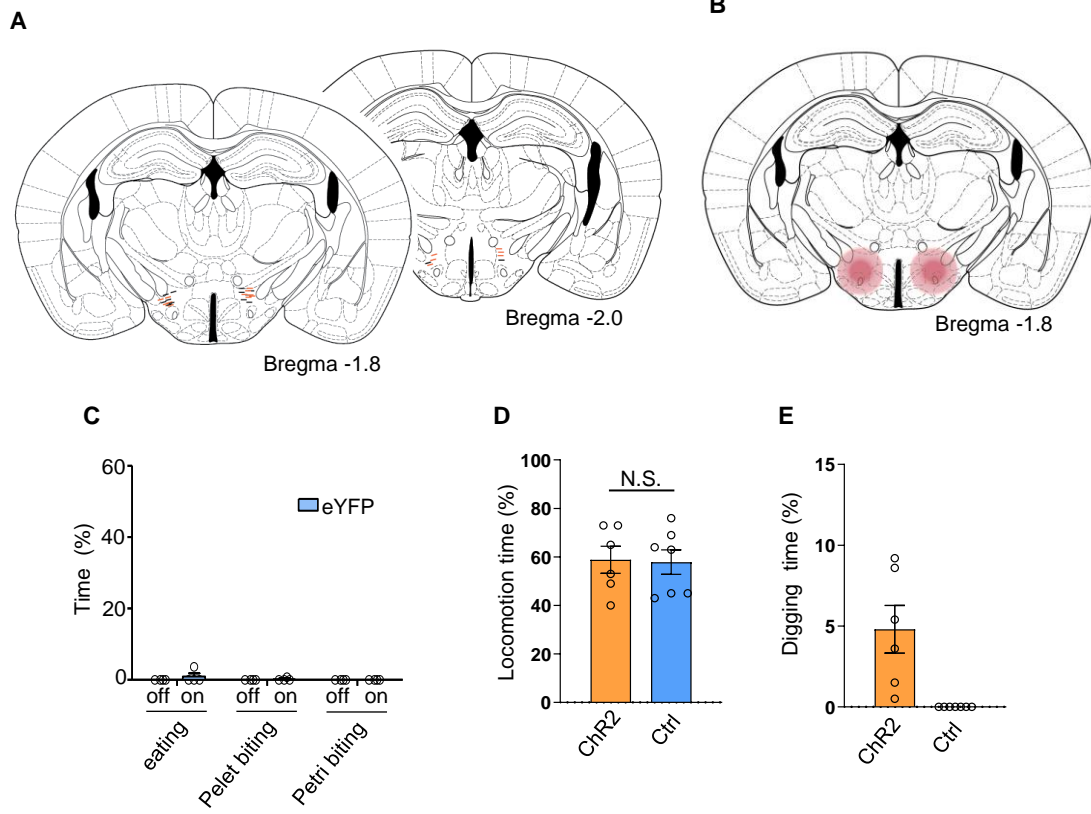
Figure S2. (A) Schematic of optic fibers placements in the LHA (Orange: ChR2, Black: Control). (B) Schematic of injection area of AAV-*hSyn::DIO-hM4D-ires-mCherry* and AAV-

hSyn::DIO-mCherry in LHA (dark red: estimated injection area, light red: virus spreading area). (C) Percentage of time spent eating (left) and biting the food pellet (center) or petri dish (left) in control animals. (D) Locomotion time ($P = 0.81$) and (E) digging time ($P = 0.0006$) in the stimulation chamber in ChR2 and control animals (Mann-Whitney test)

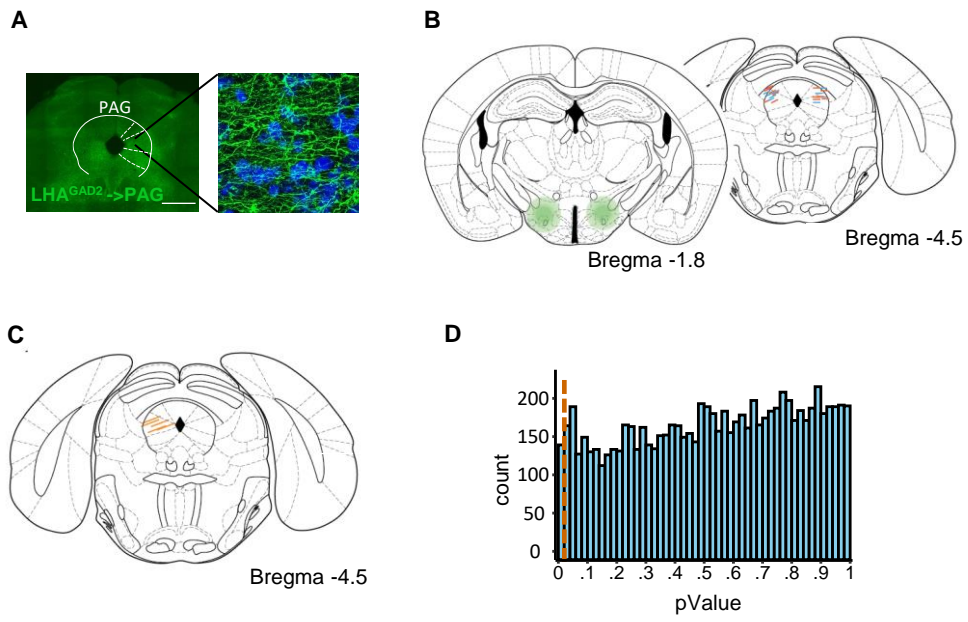
Figure S3. (A) PAG section showing ChR2 reporter expression in LHA *Gad2+* projections (Right: magnification of lPAG, Blue: DAPI staining). (B) (left) Schematic of AAV5-*Efla::DIO-ChR2-EYFP* and AAV5-*Efla::DIO-EYFP* injection area in the LHA (dark green: estimated injection area, light green: virus spreading area) and (right) optogenetic fibers placement in the PAG (Orange: ChR2, Blue: control). (C) Schematic of GRIN lens placements in the PAG. (D) Histogram of P-values obtained in a bootstrap test. The positions of the attack events in each recording were scrambled and the P-value of the change in activity at the randomized events calculated for each neuron. The process was repeated 100 times. The 100 P-values of each neuron are reported in the histogram. The vertical red dashed line represents the $P = 0.02$ cutoff.



Supplementary Figure 1



Supplementary Figure 2



Supplementary Figure 3