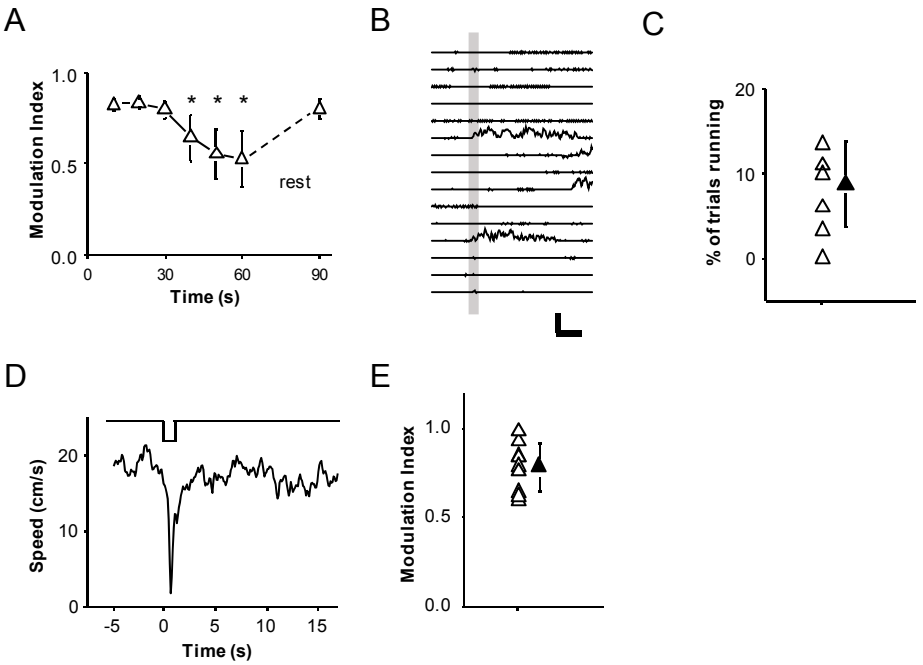

Figure S1. Additional characterization experiments related to the arrest behavior (related to Figure 1).

(**A**) Modulation index of an example animal plotted over time. The MI was measured every 10 minutes. The MI did not decrease until after 30 minutes. This adaptation recovered after 30 minutes of rest without applying flash stimulation. *, $p<0.05$, one-way ANOVA post hoc test, compared to the MI measured for the first 10 minutes.

(**B**) Sample speed traces for an animal with the initial stationary state. Gray bar indicates the duration for flash stimulation.

(**C**) Percentage of trials in which animals showed running after presenting the light flash. Solid symbol indicates mean $\pm$ SD. N = 6 animals.

(**D**) Average speed trace for an animal in response to a decrement of light. Top trace represents the change in light level.

(**E**) Summary of MIs induced by decrements of light for 7 animals. Solid symbol represents mean $\pm$ SD.

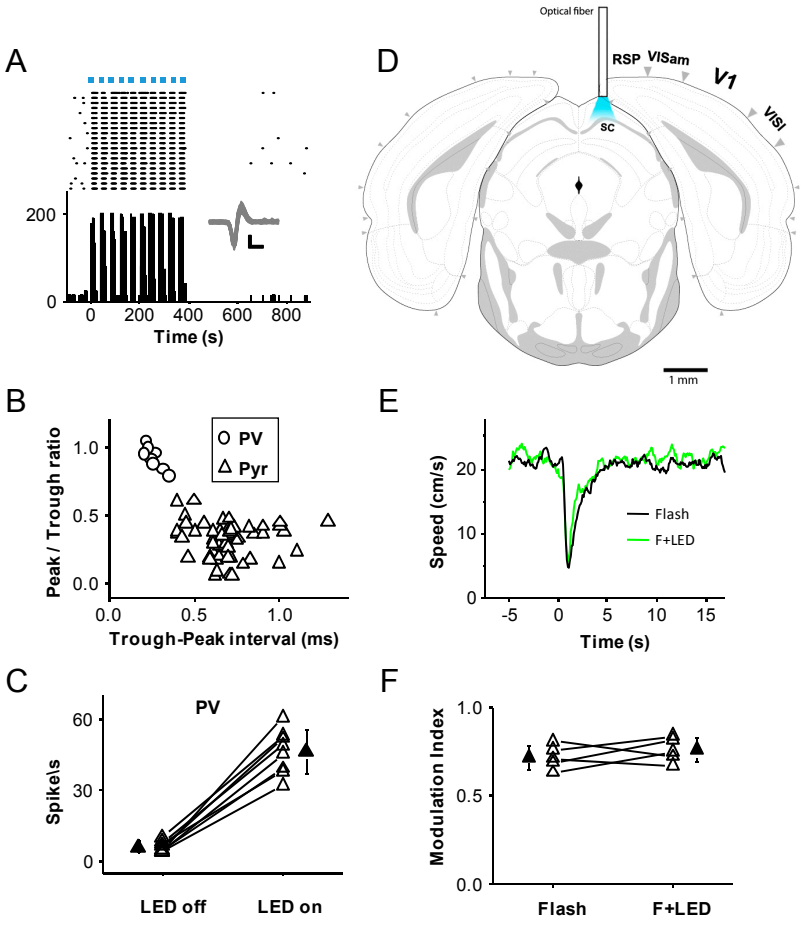

Figure S2. Recording from PV neurons and a control experiment for green LED stimulation (related to Figure 2).

(**A**) Top, raster plot of spikes of a ChR2-expressing PV neuron in response to 10 pulses of LED illumination (20 ms pulse duration, at 25 Hz), recorded with the loose-patch method. Each small blue bar indicates one LED pulse. Bottom, corresponding PSTH. Inset, 50 superimposed individual spikes during the evoked responses. Scale: 50 pA, 0.5ms. Note that the narrow spike waveform is consistent with the PV cell type.

(**B**) Plot of peak/trough ratio versus trough-peak interval for spike shapes of 8 PV neurons, which were identified by their spike responses to blue LED stimulation, and a group of blindly recorded pyramidal neurons in L5. Note that the PV cell group is segregated from the pyramidal cell group based on the spike shape parameters.

(**C**) Firing rates of PV neurons without (LED off) and with (LED on) LED stimulation. Data points for the same cell are connected with a line.

(**D**) Schematic illustration of how the optic fiber was placed to illuminate the SC surface. Note that the SC region was largely overlaid by the retrosplenial cortex (RSP).

(**E**) Average speed traces of an animal expressing GFP only in the L5 of V1, in response to flash only (black), and flash plus green LED stimulation (green).

(**F**) Modulation indices under flash only, and flash plus LED stimulation for 5 control GFP-expressing animals. Data points for the same animal are connected with a line. There is no significant difference between two conditions ($p > 0.05$, paired t-test).

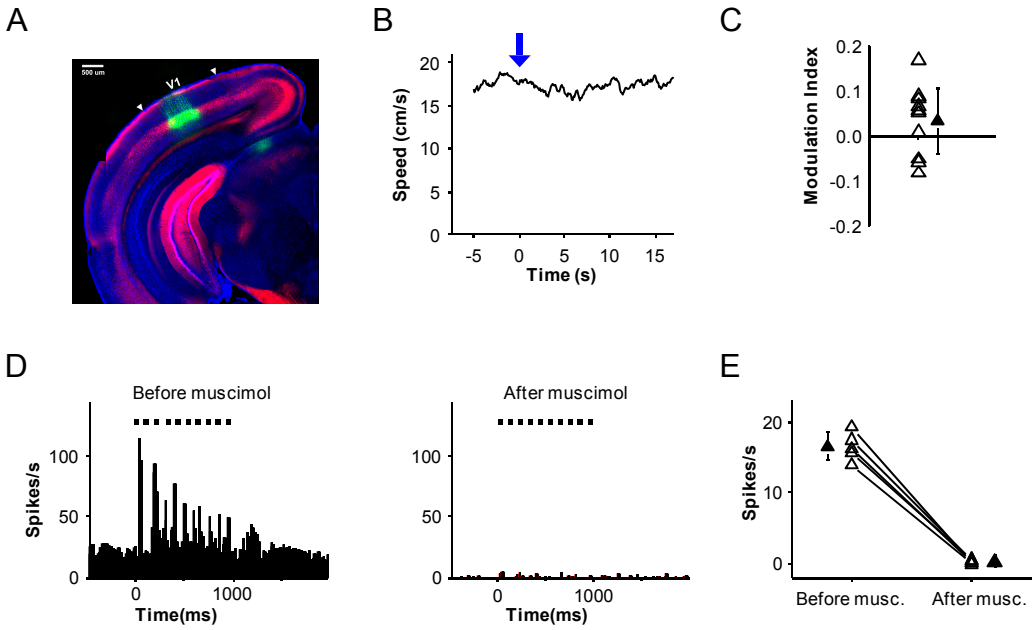

Figure S3. Control experiment for blue LED stimulation and V1 silencing (related to Figure 3).

(**A**) An fluorescence image of a brain section from a Rpb4-Cre mouse injected with AAV-FLEX-GFP. Two arrowheads mark the boundaries for V1. Note that GFP expression was restricted with V1. Scale bar: 500 μm.

(**B**) Average speed trace for a control animal expressing only GFP in V1. The speed did not change following blue LED illumination onto the visual cortex (marked by the blue arrow).

(**C**) Summary of modulation indices for 5 GFP control animals (10 sessions in total). The average MI is not significantly different from 0 ($p > 0.05$, one sample t-test).

(**D**) Spike responses of a V1 L5 neuron 10 flashes of light before (left) and after (right) injecting muscimol into the V1.

(**E**) Summary of firing rates evoked by flash stimulation before and after muscimol injections into the V1 for 6 recorded V1 neurons.