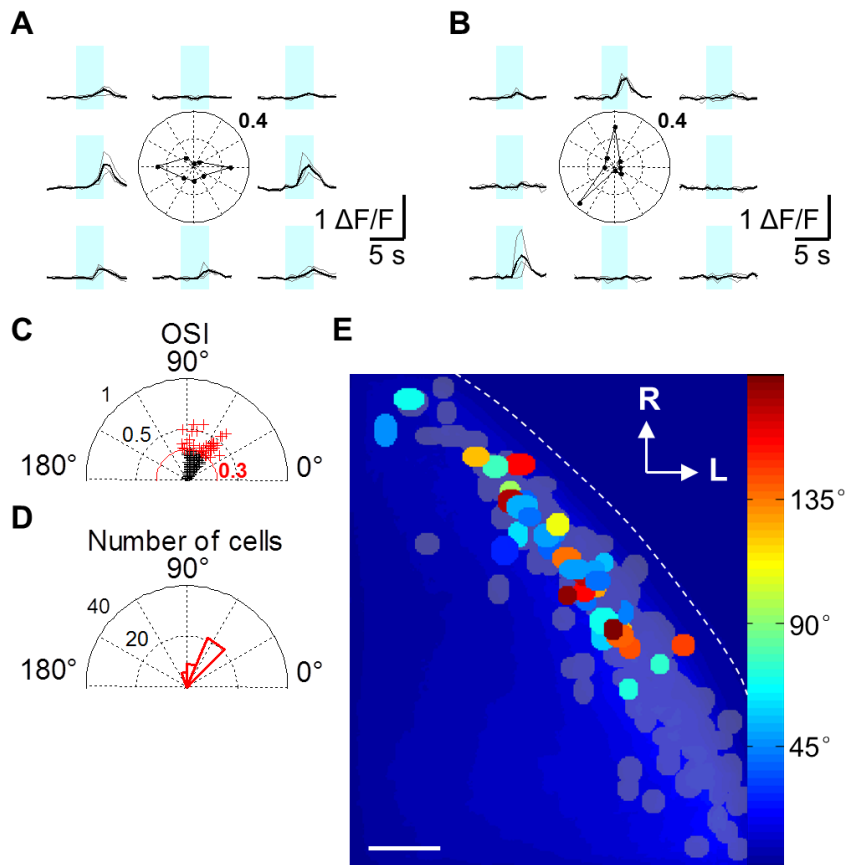
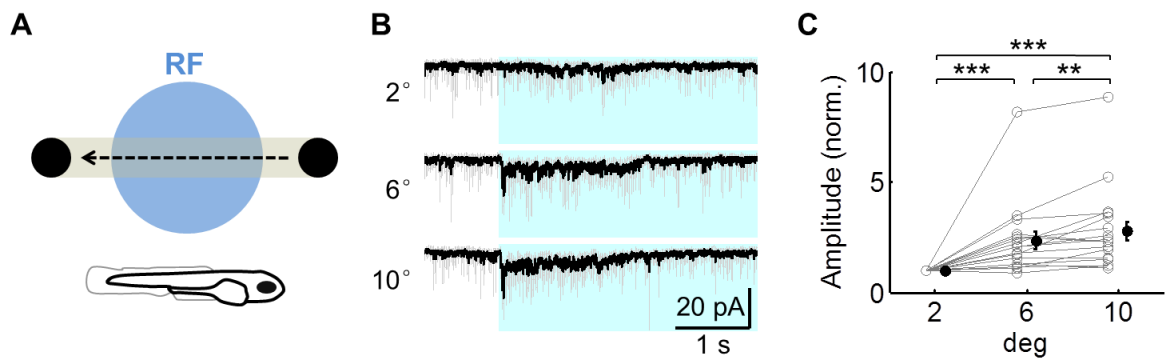


**Figure S1.** Voltage-current relationship and spatiotemporal map of SInS. **(A, B)** Current traces and summary of data ( $n = 100$ ) for voltage-current relationship. Scale bar, 20  $\mu\text{m}$ . **(C, D)** Spatiotemporal map of one SInS 50-140 ms (between gray dashed lines in **(D)**) after stimulation onset **(C)** and normalized variance of voltage responses **(D)**.

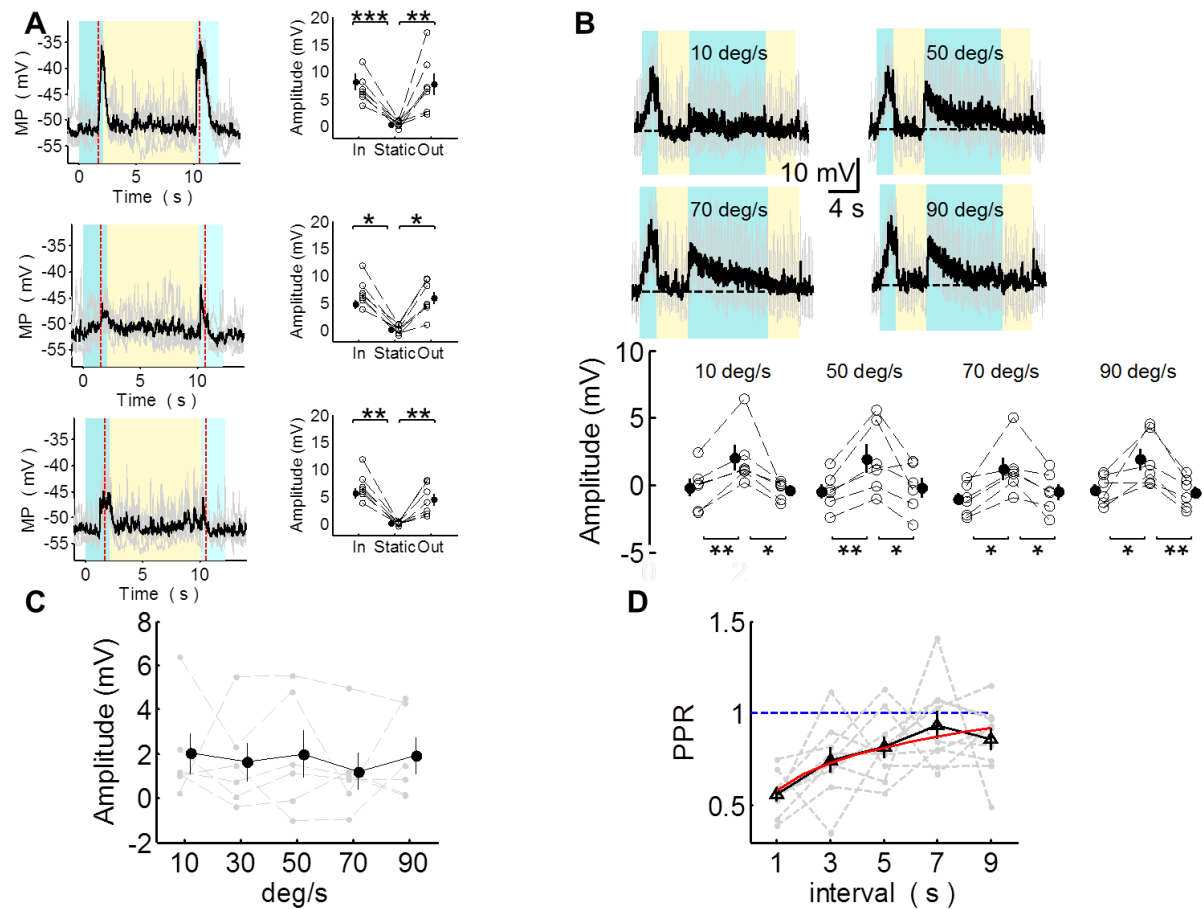


**Figure S2.** Orientation tuning of SInS. (A, B) Ca<sup>2+</sup> transients from two somata. Center: polar plot of normalized peak amplitudes of Ca<sup>2+</sup> transients. (C) Orientation selectivity index (OSI) and preferred orientation (PO) for all somata ( $n = 220$ ). Red circle marks an OSI of 0.3, used as criterion for OS. (D) Histogram of POs for all OS cells from C in red. (E) All responsive somata from grouped experiments, color-coded according to PO. Gray somata showing responsive but not OS cells. Scale bar, 20 μm.

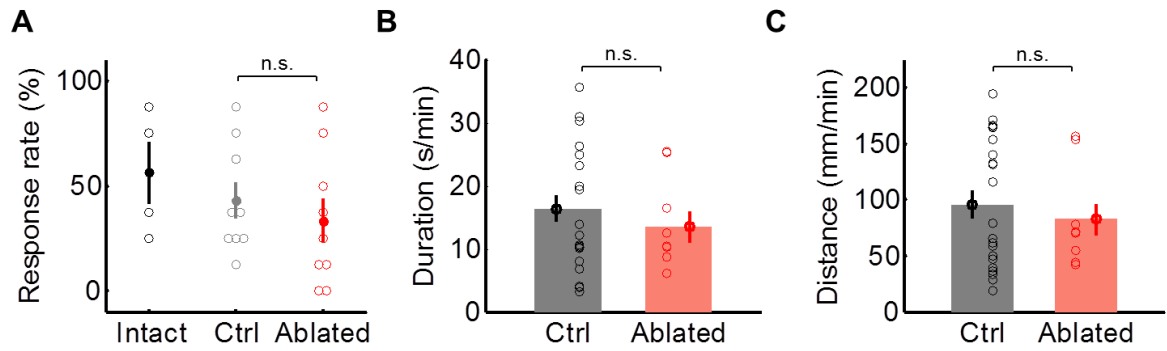


**Figure S3.** Size tuning of SInS. (A) Schematic showing moving dot stimulation. (B) Current traces showing responses to moving dots. (C) Summary of data showing

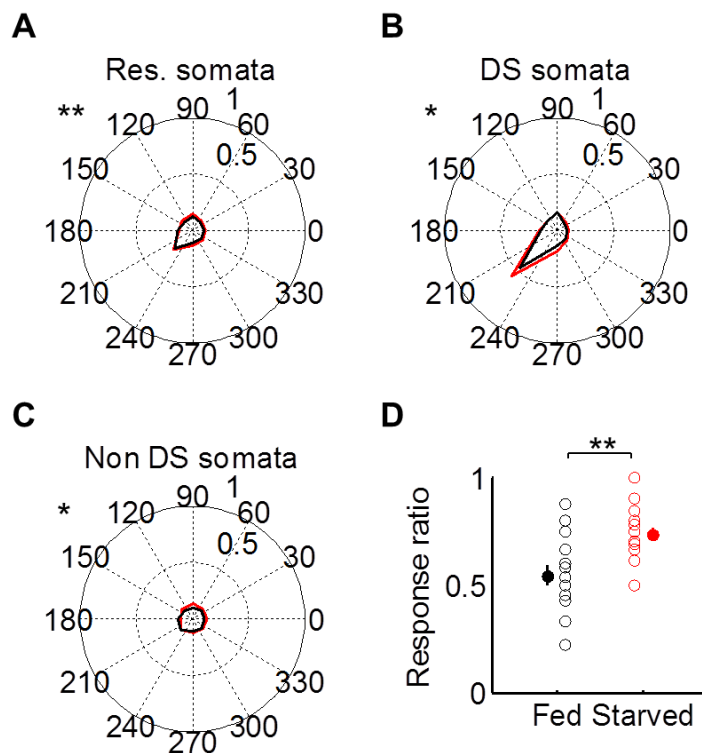
size-tuned responses to moving dots ( $n = 18$ ;  $2^\circ$  versus  $6^\circ$ :  $p = 3.9 \times 10^{-4}$ ;  $2^\circ$  versus  $10^\circ$ :  $p = 2.0 \times 10^{-4}$ ;  $6^\circ$  versus  $10^\circ$ :  $p = 0.0050$ ; all Wilcoxon signed-rank test).



**Figure S4.** SINEs detect motion objects. **(A)** Voltage traces (left panels) and summary of data (right panels) for responses to one dot in moving in direction of  $270^\circ$  ( $n = 7$ ; moving in versus static:  $p = 7.8 \times 10^{-4}$ ; moving out versus static:  $p = 0.0046$ ; Student's t-test),  $0^\circ$  ( $n = 7$ ; moving in versus static:  $p = 0.0156$ ; moving out versus static:  $p = 0.0156$ ; Wilcoxon signed-rank test) and  $90^\circ$  ( $n = 7$ ; moving in versus static:  $p = 0.0023$ ; moving out versus static:  $p = 0.0086$ ; Student's t-test) degree, respectively and static. **(B)** Voltage traces (top panels) and summary of data (bottom panels) for responses to one dot in moving in speed of 10 ( $n = 6$ ; pre-static versus circling:  $p = 0.0053$ ; circling versus post-static:  $p = 0.0335$ ; Student's t-test), 50 ( $n = 6$ ; pre-static versus circling:  $p = 0.0085$ ; circling versus post-static:  $p = 0.0457$ ; Student's t-test), 70 ( $n = 6$ ; pre-static versus circling:  $p = 0.0313$ ; circling versus post-static:  $p = 0.0313$ ; Wilcoxon signed-rank test) and 90 ( $n = 6$ ; pre-static versus circling:  $p = 0.0371$ ; circling versus post-static:  $p = 0.0033$ ; Student's t-test) degree/s, respectively and static. **(C)** Summary of data at various moving speeds ( $n = 6$ ). **(D)** Visual adaptation for PVNs ( $n = 9$ ; triangle). Red line showing power fitted curve.



**Figure S5.** SIN ablation did not affect behavioral response to stationary visual stimulation and locomotion. **(A)** Diming evoked escape unaffected in SIN ablated larvae ( $n = 9$ ) relative to control ( $n = 9$ ,  $p = 0.4875$ , Student's  $t$ -test). Intact fish serve as control. **(B)** Duration of locomotion unaffected in SIN ablated larvae ( $n = 9$ ) relative to control ( $n = 22$ ,  $p = 0.4348$ , Student's  $t$ -test). **(C)** Distance of locomotion unaffected in SIN ablated larvae ( $n = 9$ ) relative to control ( $n = 22$ ,  $p = 0.9134$ , Wilcoxon rank-sum test).



**Figure S6.** Gain modulation of SIN motion responses by brain state. **(A)** Summary of responses to moving bars from responsive somata between fed ( $n = 92/166$ ) and starved ( $n = 154/214$ ) larvae ( $p = 0.0156$ , Wilcoxon signed-rank test). **(B)** Summary of responses to moving bars from DS somata between fed ( $n = 23/166$ ) and starved ( $n =$

35/214) larvae ( $p = 0.0462$ , Wilcoxon signed-rank test). **(C)** Summary of responses to moving bars from non-DS somata between fed ( $n = 69/166$ ) and starved ( $n = 119/214$ ) larvae ( $p = 0.0437$ , Student's t-test). **(D)** Summary of ratio of responsive neurons between fed ( $n = 15$  fishes) and starved ( $n = 17$  fishes) larvae ( $p = 0.0010$ , Student's t-test)