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Corresponding author(s): David J. Anderson

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Reporting Summary

Nature Research wishes to improve the reproducibility of the work that we publish. This form provides structure for consistency and transparency in reporting. For further information on Nature Research policies, see Authors & Referees and the Editorial Policy Checklist.

Statistics

For all statistical analyses, confirm that the following items are present in the figure legend, table legend, main text, or Methods section.

n/a	Confirmed	
☐	☒	The exact sample size (n) for each experimental group/condition, given as a discrete number and unit of measurement
☐	☒	A statement on whether measurements were taken from distinct samples or whether the same sample was measured repeatedly
☐	☒	The statistical test(s) used AND whether they are one- or two-sided *Only common tests should be described solely by name; describe more complex techniques in the Methods section.*
☐	☒	A description of all covariates tested
☐	☒	A description of any assumptions or corrections, such as tests of normality and adjustment for multiple comparisons
☐	☒	A full description of the statistical parameters including central tendency (e.g. means) or other basic estimates (e.g. regression coefficient) AND variation (e.g. standard deviation) or associated estimates of uncertainty (e.g. confidence intervals)
☐	☒	For null hypothesis testing, the test statistic (e.g. F, t, r) with confidence intervals, effect sizes, degrees of freedom and P value noted *Give P values as exact values whenever suitable.*
☒	☐	For Bayesian analysis, information on the choice of priors and Markov chain Monte Carlo settings
☒	☐	For hierarchical and complex designs, identification of the appropriate level for tests and full reporting of outcomes
☒	☐	Estimates of effect sizes (e.g. Cohen's d, Pearson's r), indicating how they were calculated

Our web collection on statistics for biologists contains articles on many of the points above.

Software and code

Policy information about availability of computer code

Data collection	Calcium imaging data was acquired using commercial software from Inscopix, and processed using ImageJ + Turboreg (filtering and motion correction) followed by the MATLAB-based CNMFE package (trace extraction). For behavior assays, mouse position was tracked using Ethovision. Slice physiology was performed using pClamp11 software.
Data analysis	Microendoscopic imaging analysis and modeling were performed using custom-written MATLAB code (Matlab R2017b). Statistical testing was performed in GraphPad Prism version 6 or 7. Slice physiology was analyzed in OriginPro9.

For manuscripts utilizing custom algorithms or software that are central to the research but not yet described in published literature, software must be made available to editors/reviewers. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Research guidelines for submitting code & software for further information.

Data

Policy information about availability of data

All manuscripts must include a data availability statement. This statement should provide the following information, where applicable:

- Accession codes, unique identifiers, or web links for publicly available datasets
- A list of figures that have associated raw data
- A description of any restrictions on data availability

Behavioral and imaging data will be made available upon reasonable request. All Matlab code used for data analysis and modeling will be published to a public GitHub repository prior to publication of the paper.

Field-specific reporting

Please select the one below that is the best fit for your research. If you are not sure, read the appropriate sections before making your selection.

$\boxtimes$ Life sciences ☐ Behavioural & social sciences ☐ Ecological, evolutionary & environmental sciences

For a reference copy of the document with all sections, see nature.com/documents/nr-reporting-summary-flat.pdf

Life sciences study design

All studies must disclose on these points even when the disclosure is negative.

Sample size	No sample-size calculations were performed; sample sizes were selected based on prior experience with similar behavior assays and imaging datasets.
Data exclusions	Two mice were excluded from the microendoscopic imaging study following data acquisition, due to poor quality of collected data (unable to detect neural activity or resolvable cells.)
Replication	The iC++ open-field assay was repeated twice to confirm the validity of our initial finding: in the first experiment, transgenic+ mice were used for post-rat/during-and-post-rat silencing groups, and WT littermates were used as controls; both groups were injected with iC++ virus. In the repeat experiment, all mice were transgenic+ and mice were randomly assigned into test/control groups; control group was injected with eYFP. The two versions of the experiment produced comparable results; the first version is plotted in Fig1.
Randomization	For second version of the iC++ assay (see "Replication"), mice were randomly assigned to post-rat silencing/during+post-rat silencing/control groups.
Blinding	In the open-field iC++ assay, investigators were blind to mouse group both during the experiment and during subsequent scoring of behavior.

Reporting for specific materials, systems and methods

We require information from authors about some types of materials, experimental systems and methods used in many studies. Here, indicate whether each material, system or method listed is relevant to your study. If you are not sure if a list item applies to your research, read the appropriate section before selecting a response.

Materials & experimental systems

n/a	Involved in the study
$\boxtimes$	☐ Antibodies
$\boxtimes$	☐ Eukaryotic cell lines
$\boxtimes$	☐ Palaeontology
☐	$\boxtimes$ Animals and other organisms
$\boxtimes$	☐ Human research participants
$\boxtimes$	☐ Clinical data

Methods

n/a	Involved in the study
$\boxtimes$	☐ ChIP-seq
$\boxtimes$	☐ Flow cytometry
$\boxtimes$	☐ MRI-based neuroimaging

Animals and other organisms

Policy information about studies involving animals; ARRIVE guidelines recommended for reporting animal research

Laboratory animals	Study used male SF1-Cre mice between 8 and 20 weeks of age (obtained from the lab of Brad Lowell and maintained in Caltech animal facilities; also available from Jackson Labs, Stock No: 012462). Male Long-Evans rats (for use as predators) were obtained from Charles River at 2-3 months of age, and raised to 5-10 months in the Caltech animal facilities.
Wild animals	none
Field-collected samples	none
Ethics oversight	All experimental procedures involving the use of live animals or their tissues were performed in accordance with the NIH guidelines and approved by the Institutional Animal Care and Use Committee (IACUC) and the Institutional Biosafety Committee at the California Institute of Technology (Caltech).

Note that full information on the approval of the study protocol must also be provided in the manuscript.