

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

FreezeFrame 4 (Actimetrics) was used to acquire and automatically score freezing behavior. EthoVision XT 12 (Noldus) was used to acquire elevated plus maze and open field test recordings. Synapse (Tucker-Davis Technologies) was used for acquiring fiber photometry recordings.

Data analysis

The Observer XT 14.1 (Noldus) was used for manual scoring of freezing for photometry experiments. Prism 6 (GraphPad) and MATLAB 2018b (Mathworks) were used for all statistical analyses. FIJI, version: 2.0.0-rc-43/1.51m (Schindelin et al., 2012) was used for image analysis.

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

The data supporting this study is available from the corresponding author upon reasonable request.

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.

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](https://www.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 statistical methods were used to predetermine sample size a priori, but the sample sizes used are similar to those used in previous studies (McKenzie et al., 2014; Xiao et al., 2016).
Data exclusions	No data were excluded from the data, with the exception of one animal in the fiber photometry experiments due to a pre-determined exclusion criterion of a misplaced implant.
Replication	All behavioral and physiological experiments described were replicated successfully in at least two independent cohorts of animals.
Randomization	For all experiments involving transgenic animals, littermates were randomly assigned to experimental groups with approximately equal amounts of male and female animals. For all experiments involving C57BL/6J wildtype mice, age and sex were identical throughout cohorts and cagemates were randomly assigned to experimental groups.
Blinding	All experiments were performed and analyzed in a blinded manner, with the exception of freezing and anxiety-like behavioral analysis. These data are scored via an automated, unbiased process and thus were not explicitly performed blinded

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
<input type="checkbox"/>	<input checked="" type="checkbox"/> Antibodies
<input checked="" type="checkbox"/>	<input type="checkbox"/> Eukaryotic cell lines
<input checked="" type="checkbox"/>	<input type="checkbox"/> Palaeontology
<input type="checkbox"/>	<input checked="" type="checkbox"/> Animals and other organisms
<input checked="" type="checkbox"/>	<input type="checkbox"/> Human research participants
<input checked="" type="checkbox"/>	<input type="checkbox"/> Clinical data

Methods

n/a	Involved in the study
<input checked="" type="checkbox"/>	<input type="checkbox"/> ChIP-seq
<input checked="" type="checkbox"/>	<input type="checkbox"/> Flow cytometry
<input checked="" type="checkbox"/>	<input type="checkbox"/> MRI-based neuroimaging

Antibodies

Antibodies used	Rabbit monoclonal anti-GFP, ThermoFisher, Cat#G10362, RRID: AB_2536526, 1:1000; Chicken polyclonal anti-GFP, Aves Labs, Cat#GFP-1020, RRID: AB_2307313, 1:1000; Rabbit polyclonal anti-Olig2, Millipore, Cat#AB9610, RRID: AB_570666, 1:1000; Rabbit polyclonal anti-ASPA, Sigma-Aldrich, Cat#ABN1698, 1:1000; Rat monoclonal anti-MBP, Serotec, Cat#MCA409S, RRID: AB_325004, 1:200; Goat polyclonal anti-Fos, Santa Cruz Biotechnology, Cat# sc-52-G, RRID: AB_2629503, 1:500; Rabbit polyclonal anti-Iba1, Wako, Cat#019-19741, RRID: AB_839504, 1:1000.
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Validation	All antibodies used are commercially validated to be specific for their target for use in immunohistochemistry of mouse tissue. Representative citations for target validation are listed as follows: Rabbit monoclonal anti-GFP, PMID:19672248; Chicken polyclonal anti-GFP, PMID:24984694; Rabbit polyclonal anti-Olig2, PMID:21452201; Rabbit polyclonal anti-ASPA, PMID:15065127; Rat monoclonal anti-MBP, PMID:27618111; Goat polyclonal anti-Fos, PMID:28323938; Rabbit polyclonal anti-Iba1, PMID:16958086.
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Animals and other organisms

Policy information about [studies involving animals](#); [ARRIVE guidelines](#) recommended for reporting animal research

Laboratory animals	Myrf loxP/loxP: B6;129-Myrfm1Barr/J, Jackson Laboratories (JAX: 010607); tau-mGFP loxP/loxP: B6;129P2-Mapttm2Arbr/J, Jackson Laboratories (JAX: 021162); NG2CreERT+/-: B6.Cg-Tg(Cspg4-cre/Esr1*)BAkik/J, Jackson Laboratories (JAX: 008538); C57BL/6J, Jackson Laboratories (JAX: 000664). All experiments using transgenic animals were performed with 8 - 10 week-old male and female littermates. Experiments done with C57BL/6J animals were performed with 8 week-old males.
Wild animals	This study did not involve wild animals.
Field-collected samples	This study did not involve field-collected samples.

Ethics oversight

All procedures were pre-approved by and conducted in accordance with the U.S. NIH Guide for the Care and Use of Laboratory Animals and the Institutional Animal Care and Use Committees at the University of California, San Francisco.

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