

Reporting Summary

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Please do not complete any field with "not applicable" or n/a. Refer to the help text for what text to use if an item is not relevant to your study.
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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 (<i>n</i>) 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 <i>Only common tests should be described solely by name; describe more complex techniques in the Methods section.</i>
☒	☐ 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. <i>F</i> , <i>t</i> , <i>r</i>) with confidence intervals, effect sizes, degrees of freedom and <i>P</i> value noted <i>Give P values as exact values whenever suitable.</i>
☒	☐ 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 <i>d</i> , Pearson's <i>r</i>), 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	The raw electrophysiological signals were digitized with a multichannel extracellular amplifier (RA16PA, Tucker-Davis Technologies, FL, USA). The optical-fiber recording was carried out by a fiber photometry system (R811, RWD).
Data analysis	Statistical Analysis: unpaired t-test, one-way ANOVA, two-way ANOVA. Results were considered statistically significant when the p value < 0.05. Software: GraphPad Prism 8.0 (GraphPad, CA, USA)GraphPad Prism 8.0 (GraphPad, CA, USA), MATLAB (R2018a, The Mathworks, MA, USA)

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 and reviewers. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Portfolio [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 description of any restrictions on data availability
 - For clinical datasets or third party data, please ensure that the statement adheres to our [policy](#)

Supplementary Data 1 contain numerical source data underlying the graphs and charts presented in the Figures.

Research involving human participants, their data, or biological material

Policy information about studies with [human participants or human data](#). See also policy information about [sex, gender \(identity/presentation\), and sexual orientation](#) and [race, ethnicity and racism](#).

Reporting on sex and gender

N/A

Reporting on race, ethnicity, or other socially relevant groupings

N/A

Population characteristics

N/A

Recruitment

N/A

Ethics oversight

N/A

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

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

The sample size was chosen to ensure sufficient statistical power to detect meaningful differences between groups, considering practical constraints and ethical considerations.

Data exclusions

Mice of those virus injection or fiber tip was not in the target area were excluded from experimental analysis.

Replication

For all experiments, replications were conducted successfully. We describe detailed methods and sources of all reagents and protocols forexperiments, in order to ensure that experimental findings can be reliably reproduced.

Randomization

Mice were randomly assigned to experimental and control groups.

Blinding

All data were analyzed by investigators who were blind to the conditions of the mice and each experiment.

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
- ☐ ☒ Antibodies
- ☒ ☐ Eukaryotic cell lines
- ☒ ☐ Palaeontology and archaeology
- ☐ ☒ Animals and other organisms
- ☒ ☐ Clinical data
- ☒ ☐ Dual use research of concern
- ☒ ☐ Plants

Methods

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

Antibodies

Antibodies used

Anti-NeuN, 1:500, ab177487, Abcam, MA, USA; GAD67/Gad1 antibody, 1:300, A2938, ABclonal, Wuhan, China

Validation

The application and specificity of all the antibodies are validated by the companies.

Animals and other research organisms

Policy information about [studies involving animals](#); [ARRIVE guidelines](#) recommended for reporting animal research, and [Sex and Gender in Research](#)

Laboratory animals	C57BL/6 mice (Vital River Laboratory, Beijing, China); B6.129(Cg)-Fostm1.1(cre/ERT2)Luo/J, #021882; B6.Cg-Gt(ROSA)26Sortm14(CAG-tdTomato)Hze/J, #007914; Gad2tm2(cre)Zjh/J, #010802; B6.129P2(Cg)-Cnr1tm1.2Ltz/J, #036107 (Jackson Laboratory, ME, USA)
Wild animals Reporting	The study did not use wild animals.
on sex Field-collected	All experiments were conducted using male mice.
samples Ethics	N/A
oversight	All animal experimental protocols were approved by the Animal Ethics Committee of China Medical University in accordance with Institutional Animal Care and Use Committee guidelines for animal research.

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