nature research

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Last updated by author(s): Mar 8, 2021

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 our Editorial Policies 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	ImageJ, ImageStudio (Li-Cor), MinKNOW (Oxford Nanopore), Minimap2, Samtools, SeqMonk
Data analysis	Microsoft Excel, Origin

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 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 that support the findings of this study are available from the corresponding author upon reasonable request.

Field-specific reporting

Life sciences study design

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

Sample size	We did not predetermined the samples sizes.
Data exclusions	No data were excluded.
Replication	We only included the experimental results which were reproduced from the independent experimental sets from three individual researchers.
Randomization	The experimental model mice were randomized and selected with sex and age matched.
Blinding	We performed the measurements of any quantifications by switching the researchers who did not performed the wet-experiments with no indicated labels.

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
☒	☐ Human research participants
☒	☐ Clinical data
☒	☐ Dual use research of concern

Methods

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

Antibodies

Antibodies used

Rabbit polyclonal Anti HA-ChIP Grade (Cat#ab9110;RRID:AB_307019), Rabbit polyclonal Anti-GPR151 (AVIVA SYSTEMS BIOLOGY, OAAF06441), Rat monoclonal Anti-alpha tublin(YOL1/34) (Cat#sc-53030; RRID: AB_2272440), Rabbit monoclonal Anti-c-Jun(60A8) (Cat#9165s;RRID:AB_2130165), Rabbit polyclonal Anti-STMN2 (Cat#NBP1-49461; RRID:AB_10011569), Rabbit polyclonal Anti-Beta III tubulin, Cat#ab18207; RRID:AB_444319), Chicken polyclonal Anti-Beta III tubulin (Cat#ab41489; RRID:AB_727049), Mouse monoclonal Anti-GAPDH (Cat#sc-32233; RRID: AB_627679), Rabbit monoclonal Anti-DYKDDDDK tag(D6W5B) (Cat#14793;RRID:AB_2572291)

Validation

Rabbit polyclonal Anti HA-ChIP Grade (Cat#ab9110;RRID:AB_307019) : https://www.abcam.com/ha-tag-antibody-chip-grade-ab9110.html, "Research with confidence – consistent and reproducible results with every batch"

Rabbit polyclonal Anti-GPR151 (AVIVA SYSTEMS BIOLOGY, OAAF06441) : https://www.avivasysbio.com/gpr151-antibody-oaaf06441.html, We validated this antibody using mouse tissues extract prepared from Gpr151 protein null mice.

Rat monoclonal Anti-alpha tublin(YOL1/34) (Cat#sc-53030; RRID: AB_2272440) : https://datasheets.scbt.com/sc-53030.pdf

Rabbit monoclonal Anti-c-Jun(60A8) (Cat#9165s;RRID:AB_2130165) : https://www.cellsignal.com/products/primary-antibodies/c-jun-60a8-rabbit-mab/9165, "Western blot analysis of extracts from control HeLa cells (lane 1) or c-Jun knockout HeLa cells (lane 2) using c-Jun (60A8) Rabbit mAb #9165. The absence of signal in the c-Jun knockout HeLa cells confirms specificity of the antibody for c-Jun."

Rabbit polyclonal Anti-STMN2 (Cat#NBP1-49461; RRID:AB_10011569) : https://www.novusbio.com/products/stathmin-2-stmn2-antibody_nbp1-49461#reviews-publications

Rabbit polyclonal Anti-Beta III tubulin, Cat#ab18207; RRID:AB_444319) : https://www.abcam.com/beta-iii-tubulin-antibody-neuronal-marker-ab18207.html#lb "ab18207 was shown to recognize beta III Tubulin in wild-type HAP1 cells as signal was lost in beta III Tubulin knockout cells. An additional cross-reactive band at 50 kDa was observed in wild-type and knockout cells. Due to the immunogen's homology with TUB (Tubby protein homolog, Uniprot: P50607), this lower band could correspond to the TUB protein. Please note that cross-reactivity with this protein has not been confirmed experimentally."

Chicken polyclonal Anti-Beta III tubulin (Cat#ab41489; RRID:AB_727049) : https://www.abcam.com/beta-iii-tubulin-antibody-ab41489.html

Mouse monoclonal Anti-GAPDH (Cat#sc-32233; RRID: AB_627679) : https://www.scbt.com/ko/p/gapdh-antibody-6c5

Rabbit monoclonal Anti-DYKDDDDK tag(D6W5B) (Cat#14793;RRID:AB_2572291) : https://www.cellsignal.com/products/primary-antibodies/dykddddk-tag-d6w5b-rabbit-mab-binds-to-same-epitope-as-sigma-s-anti-flag-m2-antibody/14793

Eukaryotic cell lines

Policy information about cell lines

Cell line source(s)	HEK293T cells from ATCC (https://www.atcc.org/products/all/crl-3216.aspx)
Authentication	https://www.atcc.org/products/all/crl-3216.aspx
Mycoplasma contamination	No positive detection of Mycoplasma from bi-month routine checks.
Commonly misidentified lines (See ICLAC register)	Not applicable.

Animals and other organisms

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

Laboratory animals	MouseL: RiboTag: Rpl22tm1.1Psam; Mouse: Advillin-Cre: Aviltm2(cre)Fawa; Mouse: CD-1: Crl:CD1(ICR); Mouse: C57BL/6J: C57BL/6J; Mouse: KO: Gpr151tm1Dgen
Wild animals	No wild animals were used.
Field-collected samples	No field-collected samples were used.
Ethics oversight	all the experiments were carried out in accordance with the Korea University Institutional Animal Care & Use Committee (KU-IACUC).

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