nature portfolio

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Last updated by author(s): Feb 28, 2023

Reporting Summary

Nature Portfolio 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 Portfolio 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	PCR data were collected by Roche LightCycler96; WB data were collected by Tanon GelCap; microscopys data were collected by Leica Applicatiuon Suite (Version 4.13.0).
Data analysis	Data were analyzed by Graphpad Prism 9.0; blots were analyzed by ImageJ2; reasonable image processing and figure typesetting performed by Photoshop 2022.

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

The data used or analyzed in this study are available from the corresponding author upon reasonable request.

Human research participants

Policy information about studies involving human research participants and Sex and Gender in Research.

Reporting on sex and gender	No human specimens or data were used in this study.
Population characteristics	No human specimens or data were used in this study.
Recruitment	No human specimens or data were used in this study.
Ethics oversight	No human specimens or data were used in this study.

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

Life sciences study design

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

Sample size	This study did not involve human data or tissues and only used cell lines or genetically homogenous C57BL/6J mice. Considering the 4R principles of animal experiments (reduction, refinement, replacement, responsibility), typical sample size choices in most articles, and the production cycle of the adenoviral vector used in this study, we initially set the sample size to six mice per group.
Data exclusions	Experimental Data Exclusion Criteria: 1.Data obtained from experimental subjects that had incomplete or missing data. 2.Data obtained from experimental procedures that were not performed according to the study protocol or that had technical issues affecting the accuracy or reliability of the results. 3.Outlier data points that were identified as statistically significant and were confirmed by appropriate statistical tests. 4.Data obtained from experimental procedures that had been contaminated or compromised by external factors (e.g., environmental, biological, or chemical factors). 5.Data obtained from experimental procedures that had failed quality control measures, including instrument calibration, accuracy checks, and other quality control procedures.
Replication	All experimental findings were verified by at least three independent repeated experiments.
Randomization	The mice were grouped by assigning a random number to each subject using Excel's random number function Rand(), followed by sorting according to the random number and dividing them into several groups as needed.
Blinding	The investigators were blinded to group allocation during data collection and analysis.

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

Methods

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

Antibodies

Antibodies used	Fot WB: PRMT4 (Bethyl Laboratories, Cat: #A300-421A, 1:1 000), NCOA4 (Bethyl Laboratories, Cat: #A302-272A, 1: 1 000), GPX4 (Abcam, Cambridge, MA, USA. Cat: #ab125066, 1: 1 000), FTH1 (Abcam, Cat: #ab183781, 1: 1 000), KIM1 (R&D Systems, Cat: #AF1817, 0.25 µg/mL), NGAL (R&D Systems, Cat: #AF1857, 0.25 µg/mL), Flag (Sigma-Aldrich, Cat: #F1804, 1: 5 000), Myc (Proteintech, Wuhan, Hubei, China. Cat: #16286-1-AP, 1: 5 000), GFP (Proteintech, Cat: #66002-1-Ig, 1: 5 000), AsymAmetric Di-Methyl Arginine Motif (ADMA, Cell Signaling Technology, Danvers, MA, USA. Cat: #13522S, 1:1 000), β-Actin (Proteintech, Cat: #66009-1-Ig, 1: 5 000), GAPDH (Proteintech, Cat: #60004-1-Ig, 1: 5 000), α-Tublin (Proteintech, Cat: #66031-1-Ig, 1: 5 000), secondary antibody anti-Mouse (Proteintech, Cat: #SA00001-1, 1: 5 000), secondary antibody anti-Rabbit (Proteintech, Cat: #SA00001-2, 1: 5 000), and secondary antibody anti-Goat (Proteintech, Cat: #SA00001-4, 1: 5 000). For immunohistochemistry staining: PRMT4 (Bethyl Laboratories, Cat: #A300-421A, 1:200), NCOA4 (Bethyl Laboratories, Cat No: #A302-272A, 1: 200), GPX4(Abcam, Cat: #ab125066, 1: 200), FTH1 (Abcam, Cat: #ab183781, 1: 200), Anti-Mouse IgG-HRP (Abcam, Cat: #ab6789, 1: 500), and Anti-Rabbit IgG-HRP (Abcam, Cat: #ab97051, 1: 500). For immunofluorescence staining: FTH1 (Santa Cruz, Cat: #sc-376594, 1: 20), PRMT4 (Bethyl Laboratories, Hamburg, Germany. Cat: #A300-421A, 1:200), AQP1 (Santa Cruz, Cat: #sc-25287, 1: 50), LAMP1 (Abmart, Shanghai, China. Cat: #TD7033S, 1: 100), 4-HNE (R&D Systems, Cat: #MAB3249, 1:100), GFP (Proteintech, Cat: #66002-1-Ig, 1: 200), Anti-Rabbit IgG-Alexa Fluor 488 (Abcam, Cat: #ab150077, 1: 500), Anti-Mouse IgG-Alexa Fluor 488 (Abcam, Cat: #150113, 1: 500), Anti-Rabbit IgG-Alexa Fluor 594 (Abcam, Cat: #ab150080, 1: 500), and Anti-Mouse IgG-Alexa Fluor 594 (Abcam, Cat: #150116, 1: 500). For Co-IP: Flag (Sigma-Aldrich, Cat: #F1804), Myc (Proteintech, Cat: #16286-1-AP), Rabbit IgG (Proteintech, Cat: #B900610), and Mouse IgG (Proteintech, Cat: #B900620).
Validation	Fot WB: PRMT4 (Bethyl Laboratories, Cat: #A300-421A, 1:1 000), NCOA4 (Bethyl Laboratories, Cat: #A302-272A, 1: 1 000), GPX4 (Abcam, Cambridge, MA, USA. Cat: #ab125066, 1: 1 000), FTH1 (Abcam, Cat: #ab183781, 1: 1 000), KIM1 (R&D Systems, Cat: #AF1817, 0.25 µg/mL), NGAL (R&D Systems, Cat: #AF1857, 0.25 µg/mL), Flag (Sigma-Aldrich, Cat: #F1804, 1: 5 000), Myc (Proteintech, Wuhan, Hubei, China. Cat: #16286-1-AP, 1: 5 000), GFP (Proteintech, Cat: #66002-1-Ig, 1: 5 000), AsymAmetric Di-Methyl Arginine Motif (ADMA, Cell Signaling Technology, Danvers, MA, USA. Cat: #13522S, 1:1 000), β-Actin (Proteintech, Cat: #66009-1-Ig, 1: 5 000), GAPDH (Proteintech, Cat: #60004-1-Ig, 1: 5 000), α-Tublin (Proteintech, Cat: #66031-1-Ig, 1: 5 000), secondary antibody anti-Mouse (Proteintech, Cat: #SA00001-1, 1: 5 000), secondary antibody anti-Rabbit (Proteintech, Cat: #SA00001-2, 1: 5 000), and secondary antibody anti-Goat (Proteintech, Cat: #SA00001-4, 1: 5 000). For immunohistochemistry staining: PRMT4 (Bethyl Laboratories, Cat: #A300-421A, 1:200), NCOA4 (Bethyl Laboratories, Cat No: #A302-272A, 1: 200), GPX4(Abcam, Cat: #ab125066, 1: 200), FTH1 (Abcam, Cat: #ab183781, 1: 200), Anti-Mouse IgG-HRP (Abcam, Cat: #ab6789, 1: 500), and Anti-Rabbit IgG-HRP (Abcam, Cat: #ab97051, 1: 500). For immunofluorescence staining: FTH1 (Santa Cruz, Cat: #sc-376594, 1: 20), PRMT4 (Bethyl Laboratories, Hamburg, Germany. Cat: #A300-421A, 1:200), AQP1 (Santa Cruz, Cat: #sc-25287, 1: 50), LAMP1 (Abmart, Shanghai, China. Cat: #TD7033S, 1: 100), 4-HNE (R&D Systems, Cat: #MAB3249, 1:100), GFP (Proteintech, Cat: #66002-1-Ig, 1: 200), Anti-Rabbit IgG-Alexa Fluor 488 (Abcam, Cat: #ab150077, 1: 500), Anti-Mouse IgG-Alexa Fluor 488 (Abcam, Cat: #150113, 1: 500), Anti-Rabbit IgG-Alexa Fluor 594 (Abcam, Cat: #ab150080, 1: 500), and Anti-Mouse IgG-Alexa Fluor 594 (Abcam, Cat: #150116, 1: 500). For Co-IP: Flag (Sigma-Aldrich, Cat: #F1804), Myc (Proteintech, Cat: #16286-1-AP), Rabbit IgG (Proteintech, Cat: #B900610), and Mouse IgG (Proteintech, Cat: #B900620).

Eukaryotic cell lines

Policy information about cell lines and Sex and Gender in Research

Cell line source(s)	BUMPT cells (The Boston University mouse proximal tubular cell line, was initially obtained from Drs. William Lieberthal and John Shwartz; HK-2 cell lines & HEK293 cell lines were purchased from Abiowell Biotechnology Co., Ltd.
Authentication	BUMPT cells (The Boston University mouse proximal tubular cell line, was initially obtained from Drs. William Lieberthal and John Shwartz; HK-2 cell lines & HEK293 cell lines were provided by Abiowell Biotechnology Co., Ltd. and had been authenticated using STR profiling within the last three years.
Mycoplasma contamination	mycoplasma contamination had been tested negative among all cell lines.
Commonly misidentified lines (See ICLAC register)	None.

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	Mice: C57BL/6J, 8~12 weeks, male.
Wild animals	The study didn't involve wild animals.
Reporting on sex	All mice were male and lack of sex-based analysis.
Field-collected samples	The study didn't involve samples collected from the field.
Ethics oversight	All the animals were acclimated under standard laboratory conditions. And all procedures had been reviewed and approved by the

Ethics oversight | Institutional Animal Care and Use Committee (IACUC), The Second Xiangya Hospital, Central South University, China. Approval No.20220483.

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