nature portfolio

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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	ImageScope, iTecan, ExpeData, QuantStudio, NanoDrop2000, Imagelab
Data analysis	GraphPad Prism v8.0, Microsoft Excel, Fiji with ImageJ, GSEA, SPSS

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 RNAseq datasets generated in this study will be made available in the SRA database repository. Figs 2D, 5E and S2A-E contain data from RNAseq dataset.

Field-specific reporting

Life sciences study design

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

Sample size	No calculation of sample size was performed. Sample size (n) for each experiment is included in the figure legend. Experiments were performed with at least 2 replicates
Data exclusions	No data was excluded from the study.
Replication	Experiments in which statistical analysis was not applicable were replicated at least three times. Other experiments were replicated at least once.
Randomization	Study was not randomized.
Blinding	Researchers were not blinded. Experimental and control samples were processed together using the same conditions.

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
[ ]	[x] Antibodies
[ ]	[x] Eukaryotic cell lines
[x]	[ ] Palaeontology and archaeology
[ ]	[x] Animals and other organisms
[ ]	[x] Human research participants
[ ]	[x] Clinical data
[x]	[ ] Dual use research of concern

Methods

n/a	Involved in the study
[x]	[ ] ChIP-seq
[x]	[ ] Flow cytometry
[x]	[ ] MRI-based neuroimaging

Antibodies

Antibodies used	Cell Signaling: Phospho-p44/42 MAPK (Erk1/2) (Thr202/Tyr204) Antibody (9101), p44/42 MAPK (Erk1/2) (137F5) (4695), pS563 HSL (4139), HSL (4107), pT108/pY182 p38 (9211), p38 (9212), HSP90 (4874s) mGS (3886s) pGS (47043). Turbo-GFP (PA5-22688, Thermofisher), hGP (TA350315, AMSBIO), hGS (22371-1-AP, PROTEINTECH), mGP (19716-1-AP, PROTEINTECH), UCP1 (ab10983, Abcam), DIO2 (ab135711, Abcam)
Validation	Antibodies were used according to the manufacturer instructions

Eukaryotic cell lines

Policy information about cell lines

Cell line source(s)	HEK293T cells were purchased from American Type Culture Collection.
Authentication	HEK293T were validated by American Type Culture Collection
Mycoplasma contamination	HEK293T cells were tested and found negative for mycoplasma contamination.
Commonly misidentified lines (See ICLAC register)	N/A

Animals and other organisms

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

Laboratory animals	2-6 months old Male C57Bl/6J mice were used in the study
Wild animals	N/A
Field-collected samples	N/A
Ethics oversight	University of California - San Diego - IACUC

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

Human research participants

Policy information about studies involving human research participants

Population characteristics	All the information about human participants has been previously published and referenced in the manuscript.
Recruitment	All the information about human participants has been previously published and referenced in the manuscript.
Ethics oversight	All the information about human participants has been previously published and referenced in the manuscript.

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

Clinical data

Policy information about clinical studies

All manuscripts should comply with the ICMJE guidelines for publication of clinical research and a completed CONSORT checklist must be included with all submissions.

Clinical trial registration	All the information about human participants has been previously published and referenced in the manuscript.
Study protocol	All the information about human participants has been previously published and referenced in the manuscript.
Data collection	All the information about human participants has been previously published and referenced in the manuscript.
Outcomes	All the information about human participants has been previously published and referenced in the manuscript.