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<br>*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<br>*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 | Leica Application Suite X |
| Data analysis | FIJI (2.3.0/1.53f51), Bitplane Imaris (9.9.1), and GraphPad Prism (9.4.1) |

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

No sequence or proteomic data has been generated in this study. All data supporting the findings of this study are available from the corresponding author upon request. A table containing image analysis values is available on FIgShare.

## 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 | *Use the terms sex (biological attribute) and gender (shaped by social and cultural circumstances) carefully in order to avoid confusing both terms. Indicate if findings apply to only one sex or gender; describe whether sex and gender were considered in study design; whether sex and/or gender was determined based on self-reporting or assigned and methods used. Provide in the source data disaggregated sex and gender data, where this information has been collected, and if consent has been obtained for sharing of individual-level data; provide overall numbers in this Reporting Summary. Please state if this information has not been collected. Report sex- and gender-based analyses where performed, justify reasons for lack of sex- and gender-based analysis.* |
| Reporting on race, ethnicity, or other socially relevant groupings | *Please specify the socially constructed or socially relevant categorization variable(s) used in your manuscript and explain why they were used. Please note that such variables should not be used as proxies for other socially constructed/relevant variables (for example, race or ethnicity should not be used as a proxy for socioeconomic status). Provide clear definitions of the relevant terms used, how they were provided (by the participants/respondents, the researchers, or third parties), and the method(s) used to classify people into the different categories (e.g. self-report, census or administrative data, social media data, etc.) Please provide details about how you controlled for confounding variables in your analyses.* |
| Population characteristics | *Describe the covariate-relevant population characteristics of the human research participants (e.g. age, genotypic information, past and current diagnosis and treatment categories). If you filled out the behavioural & social sciences study design questions and have nothing to add here, write "See above."* |
| Recruitment | *Describe how participants were recruited. Outline any potential self-selection bias or other biases that may be present and how these are likely to impact results.* |
| Ethics oversight | *Identify the organization(s) that approved the study protocol.* |

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 | No sample-size calculation was performed for this study. Experimental sample size was determined based on previous studies and experience, consistent across the field (Blengini et al., 2022; Blengini et al., 2021; Aboelenain M and Schindler K., 2021; Yang CR, et al., 2020; Cheng S., et al., 2022). We have found that these sample sizes are sufficient to ensure reproducibility and statistical rigor. |
| Data exclusions | No data were excluded from the analyses. |
| Replication | All experiments were replicated 3 to 4 times to confirm reproducibility. In addition, 2 mice were used in each replicate to take into account potential biological variability. We observed that the data were successfully replicated and show consistency. |
| Randomization | All mice used for the experiments in this studied were purchased from an external vendor. Cells were randomly distributed to control and treated groups. |
| Blinding | There was no blinding procedure applied because cells were divided into groups prior to collection and analysis. In addition, all steps of the experiments (data collection and analysis) were carried out by the same researcher. |

# 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

Primary antibodies used were:
PRC1 (Proteintech, 15617-1-AP)
CIT-K (BD Biosciences, 611376)
RACGAP1 (Santa Cruz, sc-271110)
MKLP1 (Novus Biologicals, NBP2-56923)
MKLP2 (Proteintech, 67190-1)
RPS3 (Cell Signaling Technology, 2579S)
RPS6 (Santa Cruz, sc-74459)
RPS14 (Proteintech, 16683-1-AP)
RPL24 (ThermoFisher, PA5-62450)
CHMP4B (Proteintech, 13683-1-AP)
alpha-tubulin conjugated Alexa Fluor 488 (rabbit, Cell Signaling Technology, 5063S; mouse, Invitrogen, 322588).

Secondary antibodies used were purchased from Life Technologies:
Anti-rabbit Alexa Fluor 488 (A11029)
Anti-mouse Alexa Fluor 488 (A10042)
Anti-rabbit Alexa Fluor 568 (A10042)
Anti-mouse Alexa Fluor 568 (A10037)
Anti-rabbit Alexa Fluor 633 (A21070)
Anti-mouse Alexa Fluor 633 (A21050)
Anti-rabbit Atto 647N (40839)
Anti-mouse Alexa Fluor 594 (A11032)

Validation

All antibodies were validated by suppliers:
PRC1: https://www.ptglab.com/products/PRC1-Antibody-15617-1-AP.htm
CIT-K: https://www.bdbiosciences.com/en-eu/products/reagents/microscopy-imaging-reagents/immunofluorescence-reagents/Purified-Mouse-Anti-CRIK.611376
RACGAP1: https://datasheets.scbt.com/sc-271110.pdf
MKLP1: https://www.novusbio.com/products/mklp1-antibody_nbp2-56923#datasheet
MKLP2: https://www.ptglab.com/products/KIF20A-Antibody-67190-1-Ig.htm
RPS3: https://www.cellsignal.com/products/primary-antibodies/ribosomal-protein-s3-antibody/2579
RPS6: https://datasheets.scbt.com/sc-74459.pdf
RPS14: https://www.ptglab.com/products/RPS14-Antibody-16683-1-AP.htm
RPL24: https://www.thermofisher.com/antibody/product/RPL24-Antibody-Polyclonal/PA5-62450
CHMP4B: https://www.ptglab.com/products/CHMP4B-Antibody-13683-1-AP.htm
alpha-tubulin conjugated Alexa Fluor 488 (rabbit: https://www.cellsignal.com/products/antibody-conjugates/a-tubulin-11h10-rabbit-mab-alexa-fluor-488-conjugate/5063 ; mouse: https://www.thermofisher.com/antibody/product/alpha-Tubulin-Antibody-clone-B-5-1-2-Monoclonal/322588).

# 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 | Mus musculus NSA(CF1) from Envigo; females aged 6-8 weeks |
| Wild animals | None |
| Reporting on sex | We only used female mice because our study focused on oocytes, a female-specific cell type |
| Field-collected samples | none |
| Ethics oversight | All animals were maintained in accordance with the guidelines and policies from the Institutional Animal Use and Care Committee at Rutgers University (Protocol# 201702497) and the Animal Care Quality Assurance at the University of Missouri (Reference# 9695). |

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