

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 (<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	VisiView (v.4.5.0.13), CFX Maestro (v2.2)
Data analysis	GraphPad Prism (v9.2.0), ImageJ (v1.8.0), JaCoP (v2.1.4), RNA_sticky_finder (v3.0.0; https://doi.org/10.5281/zenodo.15802323), RNA_llps (v0.9.0; https://doi.org/10.5281/zenodo.15844243), OpenMM (v7.5)

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](#)

DMS-MaPseq data have been deposited in the Sequence Read Archive (SRA) under accession numbers SRR34411012, SRR34411013, SRR34411014 and SRR34411015 and can be accessed at: <https://www.ncbi.nlm.nih.gov/bioproject/PRJNA1288049>. Microscopy images and associated data are available in the

Biolmage Archive under accession number S-BIAD2144 at: <https://www.ebi.ac.uk/biostudies/bioimages/studies/S-BIAD2144>. Other data supporting the findings of this study are available within the paper and its Supplementary Information. Source data are provided with this paper.

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

Reporting on race, ethnicity, or other socially relevant groupings

Population characteristics

Recruitment

Ethics oversight

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

Data exclusions

Replication

Randomization

Blinding

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	Mouse anti- β -actin antibody (Abcam: ab8224; dilution: 1:2000); goat anti-mouse IgG (HRP) antibody (Abcam: ab6789; dilution: 1:10000); Rabbit anti-Nanos antibody (a gift from Nakamura Lab; dilution: 1:1000); goat anti-rabbit IgG (HRP) antibody (Abcam: ab6721; dilution: 1:10000); Rabbit anti-Vasa antibody (RRID: AB2940894; dilution: 1:500); mouse anti-1B1 antibody (DSHB: AB528070; dilution: 1:50); goat anti-rabbit IgG Alexa488 antibody (Thermo Fisher: A-11070; dilution: 1:1000); goat anti-mouse IgG Alexa568 antibody (Thermo Fisher: A-11004; dilution: 1:1000).
Validation	Validation of mouse anti- β -actin antibody is described on the manufacturer's website: https://www.abcam.com/en-us/products/primary-antibodies/beta-actin-antibody-mabcam-8224-loading-control-ab8224 . Mouse anti-1B1: the staining of spetosome and fusome is consistent with the published results (PMID: 39333531). Rabbit anti-Nanos antibody was validated using both positive and negative control fly samples from the study. Rabbit anti-Vasa has been validated by the published study (PMID:37384531).

Eukaryotic cell lines

Policy information about [cell lines and Sex and Gender in Research](#)

Cell line source(s)	Drosophila Ras-attP-L1 cell line (DGRC Stock 249); Genotype: y[1] w[unspecified]; P{UAS-Ras85D.V12}, P{attP.w[+].attP}JB89B / P{Act5C-GAL4}17bFO1; the sex of the cell line is unknown.
Authentication	The cell line used in this study was not authenticated.
Mycoplasma contamination	The cell line was not tested for mycoplasma contamination.
Commonly misidentified lines (See ICLAC register)	The cell line used in this study was not reported in ICLAC.

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	Drosophila melanogaster; strains: Vasa:GFP, w1118 and its derived lines; age: 1.5-3hr embryos or 3-15-day old females.
Wild animals	This study did not involve wild animals.
Reporting on sex	Sex was not considered in the study design because all ovaries and embryos were derived from female flies. Moreover, the embryos used were at early developmental stages, when determining the sex of individual embryos is not feasible.
Field-collected samples	This study did not involve samples collected from the field.
Ethics oversight	No ethical oversight relevant.

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

Plants

Seed stocks

This study did not involve plants.

Novel plant genotypes

This study did not involve plants.

Authentication

This study did not involve plants.