

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 |
|-------------------------------------|--|
| <input type="checkbox"/> | <input checked="" type="checkbox"/> The exact sample size (n) for each experimental group/condition, given as a discrete number and unit of measurement |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> A statement on whether measurements were taken from distinct samples or whether the same sample was measured repeatedly |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> 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> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> A description of all covariates tested |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> A description of any assumptions or corrections, such as tests of normality and adjustment for multiple comparisons |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> 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) |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> For null hypothesis testing, the test statistic (e.g. F , t , r) with confidence intervals, effect sizes, degrees of freedom and P value noted
<i>Give P values as exact values whenever suitable.</i> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> For Bayesian analysis, information on the choice of priors and Markov chain Monte Carlo settings |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> For hierarchical and complex designs, identification of the appropriate level for tests and full reporting of outcomes |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> 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 | Functional and structural data were collected using a range of commonly available software as described in the methods. |
| Data analysis | Functional data were analysed using commonly available software (Clampfit 11, Fitmaster v2x90, Igor Pro 9, Origin 2019b and Microsoft Excel 2021) as described in the methods. Structural and biochemical data were also analysed with commonly available software as described in the methods (COOT 0.9.5; PHENIX1.19.2; CryoSPARC v4.2.1; RELION-3; SIMPLE v3.0.0) |

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](#)

All data within this study are included in the article and/or the Supplementary Information, and materials are available upon request. The cryoEM model and maps

of THIK-1 have been deposited in the Protein Data Bank and the EMDB database, respectively, under accession codes 9FT7 [<https://doi.org/10.2210/pdb9FT7/pdb>], and EMD-50741 [<https://www.ebi.ac.uk/pdbe/entry/emdb/EMD-50741>].

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	<input type="text" value="No human participants or human data"/>
Reporting on race, ethnicity, or other socially relevant groupings	<input type="text" value="No human participants or human data"/>
Population characteristics	<input type="text" value="No human participants or human data"/>
Recruitment	<input type="text" value="No human participants or human data"/>
Ethics oversight	<input type="text" value="No human participants or human data"/>

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	<input type="text" value="No statistical methods were used to predetermine sample sizes. Required experimental sample size were estimated based on previous established protocols in the field and the design of the experiment. The sample sizes were adequate as the differences between experimental groups were reproducible."/>
Data exclusions	<input type="text" value="No exclusion criteria were pre-established. No data was excluded from the measurements shown."/>
Replication	<input type="text" value="The number of biological replicates (n) are illustrated in the respective figures, figure legends, graphs or tables where relevant."/>
Randomization	<input type="text" value="Not considered relevant for this type of experimental study due to its design."/>
Blinding	<input type="text" value="No animal or human populations with individual assigned to groups were used and so it is not considered relevant to do double blind tests for this type of design of experimental study."/>

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	Included in the study
<input checked="" type="checkbox"/>	<input type="checkbox"/> Antibodies
<input type="checkbox"/>	<input checked="" type="checkbox"/> Eukaryotic cell lines
<input checked="" type="checkbox"/>	<input type="checkbox"/> Palaeontology and archaeology
<input type="checkbox"/>	<input checked="" type="checkbox"/> Animals and other organisms
<input checked="" type="checkbox"/>	<input type="checkbox"/> Clinical data
<input checked="" type="checkbox"/>	<input type="checkbox"/> Dual use research of concern
<input checked="" type="checkbox"/>	<input type="checkbox"/> Plants

Methods

n/a	Included in the study
<input checked="" type="checkbox"/>	<input type="checkbox"/> ChIP-seq
<input checked="" type="checkbox"/>	<input type="checkbox"/> Flow cytometry
<input checked="" type="checkbox"/>	<input type="checkbox"/> MRI-based neuroimaging

Eukaryotic cell lines

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

Cell line source(s)	HEK293 cells purchased from Merck (Sigma Aldrich)
Authentication	Cell lines were not authenticated by user.
Mycoplasma contamination	Tested negative
Commonly misidentified lines (See ICLAC register)	No commonly misidentified cell lines were used in this study

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	No live animals were used directly in this study. All oocytes used were obtained in accordance with Care and Use of laboratory Animals (NIH Publication 85-23)
Wild animals	No wild animals used in this study
Reporting on sex	Only mature female Xenopus (1-3 yr old) were used for oocytes
Field-collected samples	No field collected samples
Ethics oversight	Where required, all procedures involving Xenopus were approved by veterinarians in accordance with Care and Use of laboratory Animals (NIH Publication 85-23), and relevant ethics panels (Europa und Verbraucherschutz, IX 555 - 106759/2023 33-6/23 V)

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

Plants

Seed stocks	No plants used
Novel plant genotypes	No plants used
Authentication	No plants used