

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 checked="" type="checkbox"/> | <input 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

Data analysis

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 cryo-EM density maps have been deposited in the Electron Microscopy Data Bank (EMDB) under accession number EMD-37919 [<https://www.ebi.ac.uk/emdb/EMD-37919>] (DSR2 apo complex); EMD-37920 [<https://www.ebi.ac.uk/emdb/EMD-37920>] (DSR2 apo (partial) complex); EMD-37921 [<https://www.ebi.ac.uk/emdb/EMD-37921>] (DSR2-tube complex); EMD-37922 [<https://www.ebi.ac.uk/emdb/EMD-37922>] (DSR2H171A-tube-NAD+ complex); EMD-37923 [<https://www.ebi.ac.uk/emdb/EMD-37923>] (DSR2H171A-tube-NAD+ (partial) complex); EMD-37924 [<https://www.ebi.ac.uk/emdb/EMD-37924>] (DSR2-DSAD1 complex); EMD-37925

[<https://www.ebi.ac.uk/emdb/EMD-37925>] (DSR2-DSAD1 (partial) complex) and EMD-37926 [<https://www.ebi.ac.uk/emdb/EMD-37926>] (DSR2-DSAD1-NAD+ (partial) complex). The atomic coordinates have been deposited in the Protein Data Bank (PDB) with accession number 8WY8 [<http://doi.org/10.2210/pdb8WY8/pdb>] (DSR2 apo complex); 8WY9 [<http://doi.org/10.2210/pdb8WY9/pdb>] (DSR2 apo (partial) complex); 8WYA [<http://doi.org/10.2210/pdb8WYA/pdb>] (DSR2-tube complex); 8WYB [<http://doi.org/10.2210/pdb8WYB/pdb>] (DSR2H171A-tube-NAD+ complex); 8WYC [<http://doi.org/10.2210/pdb8WYC/pdb>] (DSR2H171A-tube-NAD+ (partial) complex); 8WYD [<http://doi.org/10.2210/pdb8WYD/pdb>] (DSR2-DSAD1 complex); 8WYE [<http://doi.org/10.2210/pdb8WYE/pdb>] (DSR2-DSAD1 (partial) complex) and 8WYF [<http://doi.org/10.2210/pdb8WYF/pdb>] (DSR2-DSAD1-NAD+ (partial) complex). This paper does not report original code. Source data are provided with this paper. Any additional information required to reanalyze the data reported in this paper is available from the lead contact upon request.

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	n/a
Reporting on race, ethnicity, or other socially relevant groupings	n/a
Population characteristics	n/a
Recruitment	n/a
Ethics oversight	n/a

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	Calculations to predetermine the sample size were not performed. The rationale of the sample size was based on the previous reported similar experiments (https://doi.org/10.1038/s41422-023-00839-7).
Data exclusions	No data excluded.
Replication	Three replicates were performed in the in vitro NADase activity, in vivo growth curve and in vivo growth toxicity assays. All these assays can be replicated successfully.
Randomization	The protein samples for the biochemical assays were randomly allocated into experimental groups.
Blinding	No blinding was performed as no grouping of samples was performed.

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

Plants

Seed stocks

n/a

Novel plant genotypes

n/a

Authentication

n/a