

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
<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. 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> |
| ☒ | ☐ | 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	For hydrodynamic radii HYDRONMR (v7c, https://leonardo.inf.um.es/macromol/programs/hydrnmr/hydrnmr.htm); for protein design PYMOL (v1.8, www.pymol.org), MASTER (v2, grigoryanlab.org/master), ROSETTA (v3.12 build2020.08.61146, rosettacommons.org); The custom codes used are available in the supplementary information file and in a Zenodo repository under accession code 7748883 [https://doi.org/10.5281/zenodo.7748883]; GPES (v4.9), Cary WinUV (v6); Jasco SpectraManager (v2rev18A)
Data analysis	Microsoft Excel v16.69, Microcal Origin v8.0; for XRay crystallography XDS (built20220820) and POINTLESS (v1.11.21), Phenix (v1.16, in bundle with Phaser v1.2, COOT v0.9.6).

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 crystal structure of ZnMETPsc1 complex has been deposited in wwPDB with the accession code 5SBG [<https://doi.org/10.2210/pdb5SBG/pdb>]. The

experimental and computational source data used in this study are available in the Supplementary Information and in the Zenodo database under accession code 7748883 [https://doi.org/10.5281/zenodo.7748883].

Human research participants

Policy information about [studies involving human research participants and Sex and Gender in Research](#).

Reporting on sex and gender 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	Particular sample-size calculations were not used. Sample-sizes were chosen based on experimental experience with previously reported designed proteins. Low-deviation between individual measurements suggests sample-sizes were sufficient.
Data exclusions	No data was excluded
Replication	Biophysical measurements (UV-Vis, CD, EPR, and CV measurements) were made in duplicates or triplicates on at least two/three independent samples with fair reproducibility. Protein purification was performed at least 10 times with reproducibility on the final purity of the products.
Randomization	No randomization was needed, exception made for standard protocols for single crystal diffraction data analysis, which was performed with well documented and standardized methods.
Blinding	Not applicable to our data collection because experiment outcome was not affected by sample identity or its knowledge.

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

Methods

n/a	Involved in the study
☒	☐ ChIP-seq
☒	☐ Flow cytometry
☒	☐ MRI-based neuroimaging