

Reporting Summary

Nature Research 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 Research policies, see [Authors & References](#) 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
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
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 | Actual version of MXCube for X-ray data collection; Clampex 10.6 for BLM measurements; UVProbe 2.33 for UV-spectroscopy measurements; data from pH meter were collected with Logger Lite 1.7. |
| Data analysis | The data were analysed using the actual versions of XDS5, AIMLESS, REFMAC5S3, PHENIX, Coot, Clampfit, Origin, HOLLOW, CHARMM36m, PROPKA, GROMACS 2018, MDAnalysis, PMEpot, HOLE_g_membered, and using PPM server and MoRDa pipeline. MEXFIT program was used for the analysis of Uv-Vis kinetic data as described. |

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/reviewers. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Research [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 list of figures that have associated raw data
- A description of any restrictions on data availability

The protein coordinate and atomic structure factor will be deposited in the Protein Data Bank (PDB), preliminary full validation report is provided. All other data are available from corresponding author upon reasonable request.

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/rr-reporting-summary-flat.pdf](https://www.nature.com/documents/rr-reporting-summary-flat.pdf)

Life sciences study design

All studies must disclose on these points even when the disclosure is negative.

| | |
|-----------------|--|
| Sample size | Sample sizes were determined based on prior literature and practices in the field. We did not use statistical methods to predetermine sample size. |
| Data exclusions | No data were excluded. |
| Replication | All attempts at replication were successful. |
| Randomization | The samples were not allocated into different groups, therefore the randomization was not required. |
| Blinding | Animal experiments were not performed in this study, so Investigators were not blinded to the experiment. |

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 | Methods |
|--|---|
| n/a Involved in the study | n/a Involved in the study |
| <input checked="" type="checkbox"/> <input type="checkbox"/> Antibodies | <input checked="" type="checkbox"/> <input type="checkbox"/> ChIP-seq |
| <input checked="" type="checkbox"/> <input type="checkbox"/> Eukaryotic cell lines | <input checked="" type="checkbox"/> <input type="checkbox"/> Flow cytometry |
| <input checked="" type="checkbox"/> <input type="checkbox"/> Palaeontology | <input checked="" type="checkbox"/> <input type="checkbox"/> MRI-based neuroimaging |
| <input checked="" type="checkbox"/> <input type="checkbox"/> Animals and other organisms | |
| <input checked="" type="checkbox"/> <input type="checkbox"/> Human research participants | |
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