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Competing interests declaration

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- ☐ We declare that one or more of the authors have a competing interest as defined by Nature Portfolio.

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Policy information about Authorship: inclusion & ethics in global research

All authors are encouraged to provide an "Inclusion & Ethics" statement where relevant.

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- Accession codes, unique identifiers, or web links for publicly available datasets
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- ☒ We have provided a full data availability statement in the manuscript.

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- ☒ All relevant accession codes are provided ☐ Accession codes will be available before publication ☐ No data with mandated deposition

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Code availability statement

For all studies using custom code or mathematical algorithm that is deemed central to the conclusions, the manuscript must include a statement under the heading "Code availability" describing how readers can access the code, including any access restrictions. Code availability statements should be provided as a separate section after the data availability statement but before the References.

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For all data presented in a plot, chart or other visual representation confirm that:

n/a | Confirmed

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- ☐ ☒ Box-plot elements are defined (e.g. center line, median; box limits, upper and lower quartiles; whiskers, 1.5x interquartile range; points, outliers)
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Does not apply

Involved in the study

- ☒ ☐ Macromolecular structural data
- ☒ ☐ Unique biological materials
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- ☒ ☐ Human embryos, gametes and/or stem cells
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I certify that all the above information is complete and correct.

Typed signature Qiwei Ye, Yaqing Zhang

Date Apr 28, 2025

