

Reporting Summary

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Please do not complete any field with "not applicable" or n/a. Refer to the help text for what text to use if an item is not relevant to your study.
For final submission: please carefully check your responses for accuracy; you will not be able to make changes later.

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	ImageJ 1.52a
Data analysis	MrBayes 3.2.6, Microsoft Excel 2013, Geomagic Warp 2017, CloudCompare v.2.13, Tracer 1.7

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

Fossils illustrated in this paper are accessioned in the Nanjing Institute of Geology and Palaeontology (catalogue numbers of NIGP-176531 to NIGP-176538, NIGP-155870, NIGP-201942). Data collected or generated during this study are included in this published article and its supplementary information files. The nomenclature acts of *Helicolocellus cantori* gen. et sp. nov. is registered in zoobank, and the Life Science Identifier for this publication is urn:lsid:zoobank.org:pub:06F779B0-BA00-41AF-A6F7-A552BA8F6BF1.LSID.

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)

Ecological, evolutionary & environmental sciences study design

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

Study description	Palaeontological study of early animal fossils collected from the late Ediacaran Shibantan Member of the Dengying Formation at Wuhe village in Yichang, Hubei Province, China.
Research sample	Fossil specimens were collected from the Shibantan Member of the Dengying Formation at Wuhe village (GPS coordinates 30.790920° 111.050583°), Hubei Province, China. All specimens described in this paper are deposited in Nanjing Institute of Geology and Palaeontology. Accession numbers of illustrated specimens are provided in the manuscript.
Sampling strategy	All specimens encountered in the excavation were collected and studied. A total of 7 specimens of <i>Helicolocellus</i> were collected. This sample size is deemed sufficient in paleontological investigations. No sample size calculation was performed.
Data collection	Fossil specimens were photographed using Nikon D850 camera and Zeiss Zoom. V16. Measurements were made on photographs of specimens using ImageJ. Laser scanning data were obtained using the Faro Design ScanArm, and processed using the software Geomagic Warp and CloudCompare.
Timing and spatial scale	Fossils were collected in 2019–2023 from stratigraphic horizons about 2 m above the base of the Shibantan Member at the Wuhe section (GPS coordinates 30.790920° 111.050583°) in the Yangtze Gorges area of South China.
Data exclusions	No data were excluded from analysis.
Reproducibility	To ensure reproducibility, details about fossil locality and stratigraphic horizon have been noted.
Randomization	N/A
Blinding	N/A
Did the study involve field work?	☒ Yes ☐ No

Field work, collection and transport

Field conditions	The field site is located in the subtropical zone. Climate is humid in the field season (summer time). The outcrop is well exposed. Excavation was required to remove slabs of fossil specimens.
Location	Located at Wuhe, Yichang, Hubei Province in South China (GPS coordinates 30.790920° 111.050583°).
Access and import/export	Collection of fossil specimens was carried out in a responsible manner and in compliance with the local, national and international laws. Specimens are publicly accessible in the Nanjing Institute of Geology and Palaeontology, China, with accession numbers provided in the manuscript.
Disturbance	Disturbance was minimised by carefully controlled excavation. Reclamation of excavation quarries will be carried out after the research project is completed.

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
☒	☐ Animals and other organisms
☒	☐ Human research participants
☒	☐ Clinical data

Methods

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

Palaeontology

Specimen provenance	The Shibantan Member of the Dengying Formation at Wuhe village (GPS coordinates 30.790920° 111.050583°), Hubei Province, China.
Specimen deposition	All specimens illustrated in this paper are deposited in the Nanjing Institute of Geology and Palaeontology, China. Accession numbers of illustrated specimens are provided in the manuscript.
Dating methods	Published U-Pb dates (Extended Data Fig. 1b).
☒ Tick this box to confirm that the raw and calibrated dates are available in the paper or in Supplementary Information.	

