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.

- 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 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

<table>
<thead>
<tr>
<th>Data collection</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data analysis</td>
<td>GraphPad Prism 8.0</td>
</tr>
</tbody>
</table>

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 data that support the findings of this study are available within the paper and the Supplementary Information. All other data are available from the authors 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.

- [x] 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://nature.com/documents/nr-reporting-summary-flat.pdf)

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**Life sciences study design**

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

<table>
<thead>
<tr>
<th>Sample size</th>
<th>The sample size used for statistical analysis is indicated in each experiment. Please see the 'Materials and Methods' section and figure legends for the detailed information.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data exclusions</td>
<td>No data were excluded from the analysis.</td>
</tr>
<tr>
<td>Replication</td>
<td>All attempts at replication were successful.</td>
</tr>
<tr>
<td>Randomization</td>
<td>No randomization was used.</td>
</tr>
<tr>
<td>Blinding</td>
<td>The investigators were blinded to group allocation during data collection and analysis.</td>
</tr>
</tbody>
</table>

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**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

<table>
<thead>
<tr>
<th>n/a</th>
<th>Involved in the study</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Antibodies</td>
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<tr>
<td></td>
<td>Eukaryotic cell lines</td>
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<tr>
<td></td>
<td>Palaeontology and archaeology</td>
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<td></td>
<td>Animals and other organisms</td>
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<td></td>
<td>Human research participants</td>
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<tr>
<td></td>
<td>Clinical data</td>
</tr>
<tr>
<td></td>
<td>Dual use research of concern</td>
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</tbody>
</table>

### Methods

<table>
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<tr>
<th>n/a</th>
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<tbody>
<tr>
<td></td>
<td>ChIP-seq</td>
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<tr>
<td></td>
<td>Flow cytometry</td>
</tr>
<tr>
<td></td>
<td>MRI-based neuroimaging</td>
</tr>
</tbody>
</table>

### Antibodies

- Antibodies used: See the 'Materials and Methods' section.
- Validation: According to the manufacturer's website.

### Eukaryotic cell lines

- Policy information about [cell lines](https://iclac.org/)
  - Cell line source(s): See the 'Materials and Methods' section.
  - Authentication: None of the cell lines used were authenticated.
  - Mycoplasma contamination: The cell lines were not tested for mycoplasma contamination.
  - Commonly misidentified lines (See ICLAC register): N/A

### Animals and other organisms

- Policy information about [studies involving animals](https:// ARRIVE guidelines](https://ARRIVEguidelines.org/), recommended for reporting animal research
- Laboratory animals: See the 'Materials and Methods' section.
Wild animals: The study did not involve wild animals.

Field-collected samples: The study did not involve samples collected from the field.

Ethics oversight: See the 'Materials and Methods' section.

Note that full information on the approval of the study protocol must also be provided in the manuscript.

Flow Cytometry

Plots

- Confirm that:
  - The axis labels state the marker and fluorochrome used (e.g. CD4-FITC).
  - The axis scales are clearly visible. Include numbers along axes only for bottom left plot of group (a 'group' is an analysis of identical markers).
  - All plots are contour plots with outliers or pseudocolor plots.
  - A numerical value for number of cells or percentage (with statistics) is provided.

Methodology

- Sample preparation: See the 'Materials and Methods' section.
- Instrument: BD FACSAria II
- Software: FlowJo X
- Cell population abundance: >10000 cells
- Gating strategy: Boundary was set when the "negative" (unstained cells) was <0.5%.

Tick this box to confirm that a figure exemplifying the gating strategy is provided in the Supplementary Information.