

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 |
|-------------------------------------|---|
| <input type="checkbox"/> | <input checked="" type="checkbox"/> The exact sample size (n) for each experimental group/condition, given as a discrete number and unit of measurement |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> A statement on whether measurements were taken from distinct samples or whether the same sample was measured repeatedly |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> 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> |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> A description of all covariates tested |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> A description of any assumptions or corrections, such as tests of normality and adjustment for multiple comparisons |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> 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) |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> 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> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> For Bayesian analysis, information on the choice of priors and Markov chain Monte Carlo settings |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> For hierarchical and complex designs, identification of the appropriate level for tests and full reporting of outcomes |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> 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 | No specific software was used for data collection |
| Data analysis | <p>HiCPro (v2.8.0): https://github.com/nservant/HiC-Pro</p> <p>FitHiC2 (v2.0.7): https://github.com/ay-lab/fithic/</p> <p>RNA-seq pipeline (v2): https://github.com/ay-lab/LJI_RNA_SEQ_PIPELINE_V2.git</p> <p>Bowtie2 (v2.1.0): http://bowtie-bio.sourceforge.net/bowtie2/index.shtml</p> <p>MACS (v2.1.1): https://github.com/macs3-project/MACS</p> <p>TC-seq (v1.20.0): https://bioconductor.org/packages/release/bioc/html/TCseq.html</p> <p>IgV Browser (v2.8.0): https://igv.org/</p> <p>bigstatr package (v1.5.12): https://cran.r-project.org/web/packages/bigstatr/index.html</p> <p>robust package (v0.7-1): https://cran.r-project.org/web/packages/robust/index.html</p> <p>limma (v3.30.13): https://bioconductor.org/packages/release/bioc/html/limma.html</p> <p>hashmap (v0.2.2): https://cran.r-project.org/src/contrib/Archive/hashmap/hashmap_0.2.2.tar.gz</p> <p>Rcpp (v1.0.6): https://cran.r-project.org/src/contrib/Archive/Rcpp/Rcpp_1.0.6.tar.gz</p> <p>Optparse (v1.20.0): https://cran.r-project.org/src/contrib/Archive/optparse/optparse_1.2.0.tar.gz</p> <p>data.table (v1.10.4-2): https://cran.r-project.org/src/contrib/Archive/data.table/data.table_1.10.4-3.tar.gz</p> <p>RcppEigen (v0.3.3.9.2): https://cran.r-project.org/web/packages/RcppEigen/index.html</p> |

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 mouse ESC, NPC and CN Hi-C data used in this study are available in the GEO database under the following accession code GSE96107. The mouse hematopoiesis Hi-C data used in this study are available in the GEO database under the following accession code GSE152918. The single-cell Hi-C data used in this study are available in the GEO database under the following accession code GSE146397. The human LCL Hi-C data used in this study are available in the GEO database under the following accession codes GSE128678 and GSE50893. These are also listed in Supplemental Table S10. All reported compartments for all cell lines, multivariate differential scores, RNA-seq, and ChIP-seq data used in this manuscript can be viewed interactively at ay-lab.github.io/dcHiC. These standalone HTML files employ dcHiC's visualization utility through the IGV browser. Source data are provided with this paper.

hg19 genome was downloaded from UCSC genome browser: <https://hgdownload.soe.ucsc.edu/goldenPath/hg19/bigZips/>

mm10 genome was downloaded from UCSC genome browser: <https://hgdownload.soe.ucsc.edu/goldenPath/mm10/bigZips/>

Human research participants

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

| | |
|-----------------------------|----------------------------------|
| Reporting on sex and gender | <input type="text" value="n/a"/> |
| Population characteristics | <input type="text" value="n/a"/> |
| Recruitment | <input type="text" value="n/a"/> |
| Ethics oversight | <input type="text" value="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

Life sciences study design

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

| | |
|-----------------|---|
| Sample size | <input type="text" value="No sample size calculation was performed since only published data is used. We utilized all samples and all replicates available, unless stated otherwise"/> |
| Data exclusions | <input type="text" value="No data was excluded from the analysis"/> |
| Replication | <input type="text" value="Analyses were conducted using different replicates when available. Reproducibility of our results were extensively characterized by downsampling of replicates, changing the contact map resolutions and by creating pseudoreplicates when needed."/> |
| Randomization | <input type="text" value="Only published data were used, therefore, no randomization was applicable."/> |
| Blinding | <input type="text" value="Only published data were used, therefore, no blinding was possible."/> |

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 | Involvement in the study |
|-------------------------------------|--|
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Antibodies |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Eukaryotic cell lines |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Palaeontology and archaeology |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Animals and other organisms |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Clinical data |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Dual use research of concern |

Methods

| n/a | Involvement in the study |
|-------------------------------------|---|
| <input checked="" type="checkbox"/> | <input type="checkbox"/> ChIP-seq |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Flow cytometry |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> MRI-based neuroimaging |