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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
☐	☒ 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	No software was used for data collection.
Data analysis	We provided code at https://github.com/XiangXuCode/CRC_metastasis_code and test demo at https://doi.org/10.5281/zenodo.14676683

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

Raw sequenced data and processed data generated from this study are deposited at the BIGD database under accession number HRA000417 (https://bigd.big.ac.cn/gsa-human/browse/HRA000417).

Research involving human participants, their data, or biological material

Policy information about studies with human participants or human data. See also policy information about sex, gender (identity/presentation), and sexual orientation and race, ethnicity and racism.

Reporting on sex and gender	The sex and gender were not considered in this study design.
Reporting on race, ethnicity, or other socially relevant groupings	Chinese patients diagnosed with CRC and willing to participate in the present study were prospectively selected. 13 patients who underwent radical resection of CRC or synchronous resection of colorectal primary tumor and liver metastases at Peking University Shougang Hospital were included in the study.
Population characteristics	Chinese patients diagnosed with CRC and willing to participate in the present study were prospectively selected. 13 patients who underwent radical resection of CRC or synchronous resection of colorectal primary tumor and liver metastases at Peking University Shougang Hospital were included in the study.
Recruitment	The inclusion criteria were as follows: 1) patients are diagnosed with colorectal adenocarcinoma; 2) primary CRC or CRC with liver metastases; and 3) no preoperative chemoradiotherapy, interventional radiology or radio frequency. Patients with hereditary CRC or multiple primary CRC were excluded.
Ethics oversight	Medical Ethics Committee of Shougang Hospital of Peking University.

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	To ensure the quality of biological samples, we obtained patients samples during surgery and store in 1mL DMEM medium containing 5% FBS on ice for short-term transportation.
Data exclusions	Rigorous quality control was applied to all sequencing data. We screened qualified data for further research.
Replication	Three repeated experiments were conducted.
Randomization	We collected matched normal colon, primary colorectal carcinoma, and liver metastasis from each patient who underwent radical resection of CRC or synchronous resection of colorectal primary tumor and liver metastases between April 2018 and September 2018 at Peking University Shougang Hospital.
Blinding	All samples were analyzed using the same code process. No need blinding.

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 and archaeology
☒	☐ Animals and other organisms
☐	☒ Clinical data
☒	☐ Dual use research of concern
☒	☐ Plants

Methods

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

Clinical data

Policy information about clinical studies

All manuscripts should comply with the ICMJE guidelines for publication of clinical research and a completed CONSORT checklist must be included with all submissions.

Clinical trial registration	Peking University Shougang Hospital Ethics Committee. IRBK-2018-001-01(G).
Study protocol	The full trial protocol can be accessed in methods of manuscript.
Data collection	13 patients who underwent radical resection of CRC or synchronous resection of colorectal primary tumor and liver metastases between April 2018 and September 2018 at Peking University Shougang Hospital were included in the study.
Outcomes	We obtained the paired RNA-seq, ATAC-seq and Hi-C data from normal colon, colorectal primary tumor and liver metastases.

Plants

Seed stocks	NA
Novel plant genotypes	NA
Authentication	NA