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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
<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

The data underlying this article are available at <https://www.ncbi.nlm.nih.gov/geo/query/acc.cgi?acc=GSE231993>. The IMC raw files, preprocessed files, exported matrix files are deposited into OMIX databases : OMIX001059 (Public available after 2022-03-25 at <https://ngdc.cncb.ac.cn/omix/view/OMIX001059>) .

Data analysis

Graph Pad prism 8, R 3.6.0., FlowJo software (TreeStar) 10.6.2, All the codes related to the analysis are publicly available at https://github.com/shaoweinuaa/NC2022_Ulcerative_colitis .

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 underlying this article are available at <https://www.ncbi.nlm.nih.gov/geo/query/acc.cgi?acc=GSE231993>. The IMC raw files, preprocessed files, exported

Human research participants

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

Reporting on sex and gender

We recruited 52 healthy and patients with UC, including 24 females and 28 males with biological sex and self-identified gender

Population characteristics

The age distribution of UC patients and healthy volunteers is 23-70 years old. At the same time, we have made a detailed description of the diagnosis, Mayo Clinic Endoscopic Subscore and the Montreal classification of UC patients (Table S2).

Recruitment

Biopsy specimens from healthy volunteers and UC patients.

Ethics oversight

The study followed the Declaration of Helsinki principles and was approved by the Medical Ethics Committee of the First Affiliated Hospital, Zhejiang University, Hangzhou, China; Tianjin Medical University General Hospital, Tianjin, China; Beijing Chaoyang Hospital, Beijing, China.

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

No calculation was performed. The standard is that samples are enough for experiment conducting.

Data exclusions

No data were excluded.

Replication

All attempts at replication were successful.

Randomization

The experiment groups is just UC and healthy control groups which were diagnosed by experienced pathologist, so there is no need for randomization.

Blinding

The patients were diagnosed with doctors using the diagnostic standard. And the samples just easily categorized to two groups, so there is no need for 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

Methods

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

Antibodies

Antibodies used

CD45 89 Y D9M8I CST 13917S

IL6 115 In 1A3B4 Proteintech 66146-1-Ig
 CD14 141 Pr EPR3653 Abcam ab226121
 FoxP3 142 Pr D6O8R CST 12653S
 CD16 143 Nd EPR16784 Abcam ab256582
 CD69 144 Nd EPR21814 Abcam ab234512
 CD4 145Nd EPR6855 Abcam ab181724
 CD8a 146 Nd C8/144B Biolegend 372902
 Collagen I 147 Sm EPR7785 Abcam ab215969
 Cleaved Caspase-3 148 Nd 5A1E CST 9664S
 CD31 149 Sm 89C2 CST 3528S
 E-cadherin 150 Nd DECMA-1 Biolegend 147302
 B7-H4 151 Eu H74 Thermofisher 14-5949-82
 VISTA 152 Sm D1L2G CST 64953S
 CD7 153 Eu EPR4242 Abcam ab230834
 CD169 154 Sm HSn 7D2 Abcam ab18619
 CD103 155 Gd EPR4166(2) Abcam ab271889
 PD-L1 156 Gd E1L3N CST 13684S
 LAG3 158 Gd D2G4O CST 15372S
 CD68 159 Tb C8/144B Biolegend 372902
 CD11b 160 Gd EPR1344 Abcam ab209970
 CD20 161 Dy IGEL/773 Abcam ab213033
 CD11c 162 Dy EP1347Y Abcam ab216655
 CD15 163 Dy HI98 BD 563872
 Granzyme B 164 Dy EPR20129-217 Abcam ab219803
 PD-1 165 Ho D4W2J CST 86163S
 Ki67 166 Er B56 BD 550609
 GATA-3 167 Er D13C9 CST 5852S
 HLA-DR 168 Er EDHu-1 Novus NB110-40686
 CD45RA 169 Tm HI100 Biolegend 304143
 CD3# 170 Er D7A6E CST 85061S
 TNF! 171 Yb 7B8A11 Proteintech 60291-1-Ig
 IL-1" 172 Yb 2A1B4 Proteintech 66737-1-Ig
 CD45RO 173 Yb UCHL1 Biolegend 304239
 CD57 174 Yb NK-1 BD 555618
 IL-2 Receptor alpha (CD25) 175 Lu EPR6452 Abcam ab215378
 Pan-Cytokeratin 176 Yb AE-1/AE-3 Biolegend 914204
 Alpha Smooth Muscle Actin 194 Pt 1A4 Biolegend 904601
 Vimentin 198 Pt D21H3 CST 5741S
 CD45 89 Y D9M8I CST 13917S
 IL6 115 In 1A3B4 Proteintech 66146-1-Ig
 CD14 141 Pr EPR3653 Abcam ab226121
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 CD7 153 Eu EPR4242 Abcam ab230834
 CD169 154 Sm HSn 7D2 Abcam ab18619
 CD103 155 Gd EPR4166(2) Abcam ab271889
 PD-L1 156 Gd E1L3N CST 13684S
 LAG3 158 Gd D2G4O CST 15372S
 Pan-cytokeratin AE-1/AE-3 biolegend 914204
 CD3e D7A6E CST 85061S
 CD11b EPR1344 abcam ab209970
 CD20 H1 BD 555677
 CD11c EP1347Y abcam ab216655
 CD45RO UCHL1 biolegend 304239
 CD45RA HI100 biolegend 304143
 CD4 EPR6855 abcam ab181724
 CD8 C8/144B biolegend 372902
 CD45 D9M8I CST 13917BF
 TNF-! 7B8A11 Proteintech 60291-1-Ig

CD45 89Y HI30 Biolegend 304045
 CD3 115In UCHT1 Biolegend 300443
 Ki-67 139La SolA15 Biolegend 350523
 CD56 141Pr HCD56 Biolegend 318345
 TCR gd 142Nd 5A6.E9 Thermofisher TCR1061
 CCR6 143Gd G034E3 Biolegend 353427
 CD134 144Nd BER-ACT35 Biolegend 350015
 IgD 145Nd IA6-2 Biolegend 348235
 CD7 146Nd CD7-6B7 Biolegend 343111
 Tim-3 147Sm F38-2E2 Biolegend 345019
 CD19 148Nd HIB19 Biolegend 302247
 CD25 149Sm M-A251 Biolegend 356102
 CD223 150Nd 874501 R&D MAB23193
 CD20 151Eu 2H7 Biolegend 302343
 CD103 152Sm B-Ly7 Thermofisher 14-1038-82
 CD161 153Eu HP-3G10 Biolegend 339919
 TIGIT 154Sm A15153G Biolegend 372702
 CD45RA 155Gd HI100 Biolegend 304143
 CCR4 156Gd L291H4 Biolegend 359402
 CD27 (metal-labeled) 157Nd O323 PLTTECH 02.01.H.0000037
 CCR7 158Gd G043H7 Biolegend 353237
 GITR 159Tb 621 Biolegend 311602
 CD28 160Gd CD28.2 Biolegend 302937
 CTLA4 161Dy 14D3 Thermofisher 14-1529-82
 Foxp3 162Dy PCH101 Thermofisher 14-4776-82
 CD57 164Dy HNK-1 Biolegend 359602
 Tbet 165Ho 4B10 Biolegend 644825
 CXCR3 166Er G025H7 Biolegend 353733
 ICOS 167Er C398.4A Biolegend 313502
 4-1BB 168Er 4B4-1 Biolegend 309802
 CD45RO 169Tm UCHL1 Biolegend 304239
 CD127 170Er A019D5 Biolegend 351337
 CD69 171Yb FN50 Biolegend 310939
 CD138 172Yb DL-101 Biolegend 352311
 GranzymeB 173Yb GB11 Thermofisher MA1-80734
 PD-1 174Yb EH12.2H7 Biolegend 329941
 BTLA 175Lu MIH26 Biolegend 344502
 HLA-DR 176Yb L243 Biolegend 307651
 CD4 (metal-labeled) 197Au RPA-T4 PLTTECH 02.01.H.0000643
 CD8 198Pt RPA-T8 Biolegend 301053
 CD45 HI30 BD 563716
 CD11b 1CRF44 BD 562721
 CD4 RPA-T4 BD 557871
 CD8 RPA-T8 BD 557746
 CD19 SJ25C1 BD 563549
 CD3 SK7 Biolegend 981002
 CD68 Y1/82A Biolegend 333808
 HLA-DR L243 Biolegend 307626
 EpCAM 9C4 Biolegend 324208
 CCR2 K036C2 Biolegend 357204
 CD45 30-F11 BD 563053
 CD11bM1/70 BD 562287
 MHCII (I-A/I-E) M5/114.15.2 BD 562564
 CD4 GK1.5 BD 552051
 F4/80 BM8 Biolegend 123114
 CD3# 17A2 Biolegend 100203
 Ly6C HK1.4 Biolegend 128036
 Ly6G 1A8 Biolegend 127605
 CD8a 53-6.7 Biolegend 100722
 TNF! MP6-XT22 Thermofisher 12-7321-82
 CD68 159 Tb C8/144B Biolegend 372902
 CD11b 160 Gd EPR1344 Abcam ab209970
 CD20 161 Dy IGEL/773 Abcam ab213033
 CD11c 162 Dy EP1347Y Abcam ab216655
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 CD57 174 Yb NK-1 BD 555618
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 Pan-Cytokeratin 176 Yb AE-1/AE-3 Biolegend 914204
 Alpha Smooth Muscle Actin 194 Pt 1A4 Biolegend 904601
 Vimentin 198 Pt D21H3 CST 5741S

Validation

IHC validation and validation statements on manufacture's website

Animals and other research organisms

Policy information about [studies involving animals](#); [ARRIVE guidelines](#) recommended for reporting animal research, and [Sex and Gender in Research](#)

Laboratory animals

C57BL/6J mice were purchased from the Model Animal Research Center of Nanjing University (China). CCR2 Knockout mice were bred in-house. Only male mice were used for the mouse colitis experiment. All mice were bred in an SPF facility under the regulation of the Institutional Animal Care & Use Committee (IACUC).

Wild animals

No wild animals were used.

Reporting on sex

Only male mice were used for the mouse colitis experiment.

Field-collected samples

All mice were bred in an SPF facility under the regulation of the Institutional Animal Care & Use Committee (IACUC).

Ethics oversight

Animal experiments were approved by the Animal Care and Medical Ethics Committee of the First Affiliated Hospital, Zhejiang University.

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

Tissue obtained by biopsies or mice colon were digested in a culture medium supplemented with 0.6 mg/mL collagenase IV (17104019, Gibco) and 0.01 mg/mL DNase I (11284932001, Merck) in a 170-rpm constant temperature shaker (Eppendorf) at 37°C for 1 hour. Digested tissues were passed through a 70 µm cell strainer (352340, BD) to acquire single-cell suspensions before centrifuging at 300 g for 5 min and resuspending in 35% Percoll (P4937, Sigma). After another centrifugation at 500 g for 5 min, cells were resuspended in 10 mL of blood lysis buffer (555899, BD) for 10 min at RT to eliminate red blood cells. Cell suspensions were centrifuged at 300 g for 5 min and then incubated with 2.5 µg/mL Fc blocker (156604 for mouse; 422302 for human, BioLegend) on ice for 15 min. The suspensions were further incubated with fluorochrome- or metal-labeled antibodies at 4°C for 30 min. The antibody panel is listed in Supplementary Table S1. The samples were washed and resuspended in PBS and supplemented with 2% FBS. For intracellular staining, BD kits (555028) were used. For FACS analysis, a five-laser flow cytometer (BD Bioscience, Fortessa) was applied. The FACS data were analyzed with FlowJo software (TreeStar).

Instrument

A five-laser flow cytometer (BD Bioscience, Fortessa)

Software

The FACS data were analyzed with FlowJo software 10.6.0(TreeStar).

Cell population abundance

The samples were washed and resuspended in PBS as the concentration of 1×10^6 / ml and supplemented with 2% FBS.

Gating strategy

All gating strategy were elaborated in figures and the text.

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