

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 ( <i>n</i> ) for each experimental group/condition, given as a discrete number and unit of measurement                                                                                                                               |
| <input type="checkbox"/>            | <input checked="" 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<br><i>Only common tests should be described solely by name; describe more complex techniques in the Methods section.</i>                                                               |
| <input checked="" type="checkbox"/> | <input 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 type="checkbox"/>            | <input checked="" 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. <i>F</i> , <i>t</i> , <i>r</i> ) with confidence intervals, effect sizes, degrees of freedom and <i>P</i> value noted<br><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 type="checkbox"/>            | <input checked="" type="checkbox"/> Estimates of effect sizes (e.g. Cohen's <i>d</i> , Pearson's <i>r</i> ), 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 serum amylase and lipase were measured and analyzed using a Roche Cobas c 701/702 (Roche Diagnostics) as well as commercial kits (Roche, Switzerland).qPCR was performed on cDNA using SYBERGreen (Vazyme, China) and LightCycler96 (Roche, Switzerland).Digital immunofluorescence images were obtained using a THUNDER scannner (Leica Thunder, Germany).Serum metabolic profiling analysis was performed with a UHPLC-Q Exactive HF-X (ThermoFisher, USA). The data for 16S rRNA sequencing were conducted by Illumina Miseq(PE300). |
| Data analysis   | The data for Flow cytometry was analyzed by FlowJo_V10.The data for serum metabolomes were analyzed through the free online platform of majorbio cloud platform (cloud.majorbio.com). The data for 16S rRNA sequencing were analyzed by Majorbio Bio-pharm Biotechnology (www.i-sanger.com).                                                                                                                                                                                                                                                |

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](#)

All the source data are included in the article and/or Supplementary Information files. The raw data that support the findings of this study are openly available in the Sequence Read Archive (SRA) database with reference number PRJNA946689 (<https://www.ncbi.nlm.nih.gov/bioproject/PRJNA946689>). The metabolomics/lipid omics raw data used in this study are available in the MetaboLights database under accession code MTBLS2678 (<https://www.ebi.ac.uk/metabolights/MTBLS2678>).

## 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                                        | Human serum samples from 11 patients with AP (5 males and 6 females, aged 30–50 years) and 9 healthy controls (4 males and 5 females, aged 28–52 years) were obtained from Zhongda Hospital, Southeast University (Nanjing, China).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Reporting on race, ethnicity, or other socially relevant groupings | All participants provided written informed consent, and the study protocol was approved by the Institutional Review Board of Zhongda Hospital (Approval No. 2025ZDSYLL060-Y01). Exclusion criteria for all participants included a history of diabetes, hypertension, coronary heart disease, or any other chronic inflammatory or metabolic disorders.                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Population characteristics                                         | All patients with AP were diagnosed according to the revised Atlanta classification, requiring at least two of the following three criteria: (i) typical abdominal pain, (ii) serum amylase or lipase levels $\geq 3$ times the upper limit of normal, and (iii) imaging findings consistent with AP. Exclusion criteria were as follows: (i) age $< 18$ years; (ii) pregnancy or lactation; (iii) history of chronic pancreatitis, pancreatic cancer, or previous pancreatic surgery; (iv) severe AP with persistent organ failure ( $> 48$ h) at admission; (v) presence of other inflammatory or infectious diseases; (vi) use of antibiotics, probiotics, or immunosuppressive agents within the 4 weeks prior to enrollment; and (vii) refusal to provide informed consent. |
| Recruitment                                                        | See above.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Ethics oversight                                                   | see above.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

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](https://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     | None. |
| Data exclusions | None. |
| Replication     | None. |
| Randomization   | None. |
| Blinding        | None. |

## 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 &amp; experimental systems

|                                     |                                                                 |
|-------------------------------------|-----------------------------------------------------------------|
| n/a                                 | Involved in the study                                           |
| <input type="checkbox"/>            | <input checked="" type="checkbox"/> Antibodies                  |
| <input type="checkbox"/>            | <input checked="" type="checkbox"/> Eukaryotic cell lines       |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Palaeontology and archaeology          |
| <input type="checkbox"/>            | <input checked="" 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           |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Plants                                 |

## Methods

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

## Antibodies

|                 |                                                                                                                     |
|-----------------|---------------------------------------------------------------------------------------------------------------------|
| Antibodies used | The antibodies used in the manuscript have been provided as supplementary table 2 in the supplementary information. |
| Validation      | The manufacturer websites have been provided for the antibodies used as supplementary table 2.                      |

## Eukaryotic cell lines

Policy information about [cell lines and Sex and Gender in Research](#)

|                                                                      |                                                                                                                            |
|----------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Cell line source(s)                                                  | The cell line sources used in the manuscript have been provided as supplementary dataset in the supplementary information. |
| Authentication                                                       | none of the cell lines used were authenticated.                                                                            |
| Mycoplasma contamination                                             | negative.                                                                                                                  |
| Commonly misidentified lines<br>(See <a href="#">ICLAC</a> register) | None.                                                                                                                      |

## 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      | six- to eight-week-old C57BL/6J male mice into three groups (Control, AP, AP+Amuc_1098) of three mice per cage and raised them under specific pathogen-free (SPF) conditions with 12-hour dark/night cycles.                                                                                                                                                                                                            |
| Wild animals            | None                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Reporting on sex        | sex was not considered in study design.                                                                                                                                                                                                                                                                                                                                                                                 |
| Field-collected samples | We randomly divided six- to eight-week-old C57BL/6J male mice into three groups (Control, AP, AP+Amuc_1098) of three mice per cage and raised them under specific pathogen-free (SPF) conditions with 12-hour dark/night cycles. Under controlled temperature (22–24°C) and humidity (50%–55%) conditions, all mice had free access to irradiated laboratory mouse and rat maintenance feed (GB14924.3-2010) and water. |
| Ethics oversight        | The animal welfare committee of Nanjing University of Chinese Medicine approved all experimental protocols for mice and followed laboratory animal care guidelines (202303A079).                                                                                                                                                                                                                                        |

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

## Plants

|                       |       |
|-----------------------|-------|
| Seed stocks           | None. |
| Novel plant genotypes | None. |
| Authentication        | None. |

## 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

Single-cell suspensions were prepared by dividing freshly harvested spleens and intestinal tract into pieces, grinding them, and filtering them through nylon mesh. After removal of erythrocytes, splenic mononuclear cells were resuspended in PBS containing 2% FBS and blocked with purified rat anti-mouse CD16/CD32 (BD Biosciences, USA) for 15 min at room temperature. Splenocytes were stained with Zombie NIRT™ Fixable Viability Kit (BioLegend, USA) for 15 min at room temperature.

Instrument

The data was analyzed by FlowJo\_V10.

Software

The data was analyzed by FlowJo\_V10.

Cell population abundance

To research the effect of Amuc\_1098 on intestinal inflammation, we isolated intestinal lamina propria lymphocytes and subsequently analyzed them using flow cytometry. Our findings revealed that treatment with Amuc\_1098 significantly decreased the proportion of intestinal macrophages in AP mice (Figure 4a)

Gating strategy

Cells were sequentially gated on lymphocytes (FSC/SSC), live cells (FVD), CD45<sup>+</sup> leukocytes, and finally CD11b<sup>+</sup>F4/80<sup>+</sup> macrophages. Representative plots are shown. These gates correspond to the FACS data in Figure 4a.

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