

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 (<i>n</i>) 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. <i>F</i> , <i>t</i> , <i>r</i>) with confidence intervals, effect sizes, degrees of freedom and <i>P</i> 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 <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	MED-PC CPP software(MED-CPP2-3013-2AT) Applied Biosystems QuantStudio5 system(Thermo) Gel Doc XR+ Imaging System (Bio-Rad) ChemiDoc XRS+(Bio-Rad) ImageJ software(NIH) GraphPad Prism(GraphPad)
Data analysis	RNA-seq data were analyzed by DESeq2 software, edgeR, fgsea package; Secondary analysis of single-cell RNA sequencing dataset using Seurat package and fgsea package; ChIP-seq data were processed and analyzed by fastp software, bowtie2, MACS2, DeepTool, ChIPseeker, and Homer; DLO Hi-C data were processed and analyzed by Hi-C Domain Caller, hiclib, SAMtools, and Juicertools.

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 data supporting the finding in the study are included in the main article and associated files. The raw sequence data reported in this paper have been deposited in the Genome Sequence Archive in National Genomics Data Center, China National Center for Bioinformation/Beijing Institute of Genomics, Chinese Academy of Sciences (GSA: CRA027738 for the DLO Hi-C of DRG; CRA027545, CRA027544, CRA027543, CRA027530, and CRA027528 for the RNA-seq of DRG, SC, BS, T, and C; CRA027527 for the RNA-seq of ZFP612 overexpression in SNL DRG; CRA023787 for the RNA-seq of ZFP612 knockdown in cultured DRG neurons; CRA023728 for the ZFP612 ChIP-seq of DRG) that are publicly accessible at <https://ngdc.cncb.ac.cn/gsa>. Source Data are provided with this paper.

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

Reporting on race, ethnicity, or other socially relevant groupings

Population characteristics

Recruitment

Ethics oversight

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

Data exclusions

Replication

Randomization

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

Antibodies

Antibodies used

Primary antibodies for Immunofluorescent staining:

Rabbit anti-ZFP612 (1:200, Proteintech, 21322-1-AP)
 Chicken anti-TUJ1 (1:500, Sigma-Aldrich, AB9354)
 Mouse anti-GS (1:500, EMD Millipore, MAB302)
 Rat anti-CD68 (1:300, Bio-Rad, MCA341GA)
 Biotinylated IB4 (1:300, Sigma-Aldrich, L2140)
 Goat anti-CGRP (1:500, Abcam, ab36001)
 Mouse anti-CGRP (1:300, Abcam, ab81887)
 Mouse anti-NF200 (1:500, Sigma-Aldrich, N0142)
 Rabbit anti-ATF3 (1:300, Abcam, ab207434)
 Rabbit anti PGP9.5 (1:500, Abcam, ab108986)
 Guinea pig anti-P2X3 (1:300, Sigma-Aldrich, AB5896)
 Mouse anti-GFAP (1:500, EMD Millipore, MAB360)
 Goat anti-IBA-1 (1:300, Abcam, ab5076)
 Rabbit anti-IL1RL1 (1:300, Abcam, ab25877)
 Rabbit anti-HDAC1 (1:100, Proteintech, 10197-1-AP)
 Rabbit anti-HDAC2 (1:100, Proteintech, 12922-3-AP)
 Rabbit anti-SETDB1 (1:100, Proteintech, 11231-1-AP)

Secondary antibodies for Immunofluorescent staining:

Cy™2 AffiniPure™ goat anti-mouse IgG (H+L) (1:300, Jackson ImmunoResearch, 115-225-146)
 Cy™3 AffiniPure™ goat anti-mouse IgG (H+L) (1:300, Jackson ImmunoResearch, 115-165-146)
 Cy™2 AffiniPure™ goat anti-rabbit IgG (H+L) (1:300, Jackson ImmunoResearch, 111-225-144)
 Cy™3 AffiniPure™ goat anti-rabbit IgG (H+L) (1:300, Jackson ImmunoResearch, 111-165-144)
 Cy™3 AffiniPure™ donkey anti-goat IgG (H+L) (1:300, Jackson ImmunoResearch, 705-165-147)
 Goat anti-rat IgG H&L (Alexa Fluor® 488) (1:300, Abcam, ab150157)
 Goat anti-chicken IgY H&L (Alexa Fluor® 488) preadsorbed (1:300, Abcam, ab150173)
 Goat anti-chicken IgY H&L (Alexa Fluor® 594) (1:300, Abcam, ab150172)
 Goat anti-guinea pig IgG H&L (Alexa Fluor® 488) (1:300, Abcam, ab150185)
 Donkey anti-rabbit IgG H&L (Alexa Fluor® 405) (1:200, Abcam, ab175651)
 Donkey anti-mouse IgG H&L (Alexa Fluor® 405) (1:200, Abcam, ab175658)
 Avidin-FITC from egg white (1:300, Sigma-Aldrich, A2050)

Primary antibodies for Western blot:

Rabbit anti-ZFP612 (1:1,500, Proteintech, 21322-1-AP)
 Mouse anti-histone H3 (1:2,000, Santa Cruz, sc-517576)
 Mouse anti-GAPDH (1:5,000, Proteintech, 60004-1-Ig)
 Mouse anti-IL1RL1 (1:5,000, Proteintech, 60112-1-Ig)
 Mouse anti-GFAP (1:2,000, CST, 3670)
 Rabbit anti-IBA-1 (1:500, WAKO, 016-20001)
 Rabbit anti-HDAC1 (1:2,000, Proteintech, 10197-1-AP)
 Rabbit anti-HDAC2 (1:2,000, Proteintech, 12922-3-AP)
 Rabbit anti-SETDB1 (1:1,000, Proteintech, 11231-1-AP)
 Rabbit anti-CBX1 (1:1,000, Proteintech, 10241-2-AP)
 Rabbit anti-CBX3 (1:1,000, Proteintech, 11650-2-AP)
 Rabbit anti-CBX5 (1:500, Proteintech, 11831-1-AP)
 Rabbit anti-KAP1 (1:3,000, Proteintech, 15202-1-AP)

Secondary antibodies for Western blot:

HRP-conjugated goat anti-rabbit IgG(H+L) (1:5,000, Elabscience, E-AB-1003)
 HRP-conjugated goat anti-mouse IgG(H+L) (1:5,000, Elabscience, E-AB-1001)
 HRP-conjugated rabbit anti-mouse IgG (Light Chain Specific; D3V2A) (1:2,000, CST, 58802)

Antibodies for protein precipitation in Co-IP assay:

Rabbit anti-ZFP612 (Proteintech, 21322-1-AP)
 Rabbit anti-HDAC1 (Proteintech, 10197-1-AP)
 Rabbit anti-HDAC2 (Proteintech, 12922-3-AP)
 Rabbit anti-SETDB1 (Proteintech, 11231-1-AP)
 Rabbit anti-CBX1 (Proteintech, 10241-2-AP)
 Rabbit anti-CBX3 (Proteintech, 11650-2-AP)
 Rabbit anti-CBX5 (Proteintech, 11831-1-AP)
 Rabbit anti-KAP1 (Proteintech, 15202-1-AP)
 Rabbit anti-IgG control (Proteintech, 30000-0-AP)

Antibodies for protein precipitation in ChIP assay:

Rabbit anti-ZFP612 (Proteintech, 21322-1-AP)
 Rabbit anti-HDAC1 (Proteintech, 10197-1-AP)
 Rabbit anti-HDAC2 (Proteintech, 12922-3-AP)
 Rabbit anti-SETDB1 (Proteintech, 11231-1-AP)
 Rabbit anti-acH3 (EMD Millipore, 06-599)
 Rabbit anti-acH4 (EMD Millipore, 06-866)
 Rabbit anti-H3K9me3 (EMD Millipore, 17-625)
 Rabbit anti-RNA polymerase II CTD repeat YSPTSPS (phospho S5) (Abcam, ab5131)
 Rabbit anti-RNA polymerase II CTD repeat YSPTSPS (phospho S2) (Abcam, ab238146)
 Rabbit anti-IgG control (Proteintech, 30000-0-AP)

Validation

Rabbit anti-ZFP612 (<https://www.ptgcn.com/products/ZNF23-Antibody-21322-1-AP.htm>)
 Chicken anti-TUJ1 (<https://www.sigmaaldrich.cn/CN/zh/product/mm/ab9354>)
 Mouse anti-GS (<https://www.sigmaaldrich.cn/CN/zh/product/mm/mab302>)
 Rat anti-CD68 (<https://www.bio-rad-antibodies.com/monoclonal/rat-cd68-antibody-ed1-mca341.html>)
 Biotinylated IB4 (<https://www.sigmaaldrich.cn/CN/zh/product/sigma/l2140>)
 Goat anti-CGRP (<https://www.abcam.cn/products/primary-antibodies/cgrp-antibody-ab36001.html>)
 Mouse anti-CGRP (<https://www.abcam.cn/products/primary-antibodies/cgrp-antibody-4901-ab81887.html>)
 Mouse anti-NF200 (<https://www.sigmaaldrich.cn/CN/zh/product/sigma/n0142>)
 Rabbit anti-ATF3 (<https://www.abcam.cn/products/primary-antibodies/atf3-antibody-epr19488-chip-grade-ab207434.html>)
 Rabbit anti-PGP9.5 (<https://www.abcam.cn/products/primary-antibodies/pgp95-antibody-epr4118-neuronal-marker-ab108986.html>)
 Guinea pig anti-P2X3 (<https://www.sigmaaldrich.cn/CN/zh/product/mm/ab5896>)
 Mouse anti-GFAP (<https://www.sigmaaldrich.cn/CN/zh/product/mm/mab360>)
 Goat anti-IBA-1 (<https://www.abcam.cn/products/primary-antibodies/iba1-antibody-ab5076.html>)
 Rabbit anti-IL1RL1 (<https://www.abcam.cn/products/primary-antibodies/st2-antibody-bsa-free-ab25877.html>)
 Rabbit anti-HDAC1 (<https://www.ptgcn.com/products/HDAC1-Antibody-10197-1-AP.htm>)
 Rabbit anti-HDAC2 (<https://www.ptgcn.com/products/HDAC2-Antibody-12922-3-AP.htm>)
 Rabbit anti-SETDB1 (<https://www.ptgcn.com/products/SETDB1-Antibody-11231-1-AP.htm>)
 Mouse anti-histone H3 (<https://www.scbt.com/zh/p/histone-h3-antibody-1g1>)
 Mouse anti-GAPDH (<https://www.ptgcn.com/products/GAPDH-Antibody-60004-1-Ig.htm>)
 Mouse anti-IL1RL1 (<https://www.ptgcn.com/products/IL1RL1-Antibody-60112-1-Ig.htm>)
 Mouse anti-GFAP (<https://www.cellsignal.com/products/primary-antibodies/gfap-ga5-mouse-mab/3670>)
 Rabbit anti-IBA-1 (<https://labchem-wako.fujifilm.com/us/product/detail/W01W0101-2000.html>)
 Rabbit anti-CBX1 (<https://www.ptgcn.com/products/CBX1-Antibody-10241-2-AP.htm>)
 Rabbit anti-CBX3 (<https://www.ptgcn.com/products/CBX3-Antibody-11650-2-AP.htm>)
 Rabbit anti-CBX5 (<https://www.ptgcn.com/products/CBX5-Antibody-11831-1-AP.htm>)
 Rabbit anti-KAP1 (<https://www.ptgcn.com/products/TRIM28-Antibody-15202-1-AP.htm>)
 Rabbit anti-IgG control (<https://www.ptglab.com/Products/IgG-control-Antibody-30000-0-AP.htm>)
 Rabbit anti-acH3 (<https://www.sigmaaldrich.cn/CN/zh/product/mm/06599>)
 Rabbit anti-acH4 (<https://www.sigmaaldrich.cn/CN/zh/product/mm/06866>)
 Rabbit anti-H3K9me3 (<https://www.sigmaaldrich.cn/CN/zh/product/mm/17625>)
 Rabbit anti-RNA polymerase II CTD repeat YSPTSPS (phospho S5)
 (<https://www.abcam.cn/products/primary-antibodies/rna-polymerase-ii-ctd-repeat-ysptsp-phospho-s5-antibody-ab5131.html>)
 Rabbit anti-RNA polymerase II CTD repeat YSPTSPS (phospho S2)
 (<https://www.abcam.cn/products/primary-antibodies/rna-polymerase-ii-ctd-repeat-ysptsp-phospho-s2-antibody-epr18855-87-chip-grade-ab238146.html>)
 Cy[™]2 AffiniPure[™] goat anti-mouse IgG (H+L) (Cat# 115-225-146; RRID:AB_2307343)
 Cy[™]3 AffiniPure[™] goat anti-mouse IgG (H+L) (<https://www.jacksonimmuno.com/catalog/products/115-165-146>)
 Cy[™]2 AffiniPure[™] goat anti-rabbit IgG (H+L) (Cat# 111-225-144; RRID:AB_2338021)
 Cy[™]3 AffiniPure[™] goat anti-rabbit IgG (H+L) (<https://www.jacksonimmuno.com/catalog/products/111-165-144>)
 Cy[™]3 AffiniPure[™] donkey anti-goat IgG (H+L) (<https://www.jacksonimmuno.com/catalog/products/705-165-147>)
 Goat anti-rat IgG H&L (Alexa Fluor[®] 488)
 (<https://www.abcam.cn/products/secondary-antibodies/goat-rat-igg-hl-alexa-fluor-488-ab150157.html>)
 Goat anti-chicken IgY H&L (Alexa Fluor[®] 488) preadsorbed
 (<https://www.abcam.cn/products/secondary-antibodies/goat-chicken-igy-hl-alexa-fluor-488-preadsorbed-ab150173.html>)
 Goat anti-chicken IgY H&L (Alexa Fluor[®] 594)

(<https://www.abcam.cn/products/secondary-antibodies/goat-chicken-igy-hl-alex-a-fluor-594-ab150172.html>)
 Goat anti-guinea pig IgG H&L (Alexa Fluor® 488)
 (<https://www.abcam.cn/products/secondary-antibodies/goat-guinea-pig-igg-hl-alex-a-fluor-488-ab150185.html>)
 Donkey anti-rabbit IgG H&L (Alexa Fluor® 405)
 (<https://www.abcam.cn/products/secondary-antibodies/donkey-rabbit-igg-hl-alex-a-fluor-405-ab175651.html>)
 Donkey anti-mouse IgG H&L (Alexa Fluor® 405)
 (<https://www.abcam.cn/products/secondary-antibodies/donkey-mouse-igg-hl-alex-a-fluor-405-ab175658.html>)
 Avidin-FITC from egg white (<https://www.sigmaaldrich.cn/CN/zh/product/sigma/a2050>)
 HRP-conjugated goat anti-rabbit IgG(H+L)
 (https://www.elabscience.cn/p-goat_anti_rabbit_igg_h_l_peroxidase_hrp_conjugated-e_ab_1003)
 HRP-conjugated goat anti-mouse IgG(H+L)
 (https://www.elabscience.cn/p-goat_anti_mouse_igg_h_l_peroxidase_hrp_conjugated-e_ab_1001)
 HRP-conjugated rabbit anti-mouse IgG (Light Chain Specific; D3V2A)
 (<https://www.cellsignal.com/products/secondary-antibodies/rabbit-anti-mouse-igg-light-chain-specific-d3v2a-mab-hrp-conjugate/58802>)

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	Wild-type male C57BL/6J mice; To obtain male Zfp612 conditional knockout mice and control littermates, male AdvillinCre/+ mice were crossed with female Zfp612f/f mice; Male Il1r1-/- mice; Male Il1r1 silencer-/- mice; Male Macaca fascicularis.
Wild animals	This study did not involve wild animals.
Reporting on sex	Male animals were used in all experiments.
Field-collected samples	Study did not involve samples collected from the field.
Ethics oversight	The animal study was reviewed and approved by the Ethics Committee of Zhejiang Animal Care and Use Committee and the Ethics Committee of the Second Affiliated Hospital of Zhejiang University School of Medicine (the protocol numbers: AIRB-2022-1496 and 2023-107) and performed following the guidelines of the International Association for the Study of Pain. Utmost care was taken to ensure the welfare of the animals and keep their usage to a minimum.

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

Plants

Seed stocks	N/A
Novel plant genotypes	N/A
Authentication	N/A

ChIP-seq

Data deposition

- ☒ Confirm that both raw and final processed data have been deposited in a public database such as [GEO](#).
☒ Confirm that you have deposited or provided access to graph files (e.g. BED files) for the called peaks.

Data access links <i>May remain private before publication.</i>	The ChIP-seq data have been deposited with links to BioProject accession number PRJCA037169 (GSA accession number: CRA023728) in the China National Center for Bioinformation/Beijing Institute of Genomics, Chinese Academy of Sciences (https://ngdc.cncb.ac.cn/gsa).
Files in database submission	Raw data: DRGZFP612_Input.R1.fq, DRGZFP612_Input.R2.fq, DRGZFP612_IP.R1.fq, DRGZFP612_IP.R2.fq. Processed data: DRG ZFP612_sel_anno_add_function.
Genome browser session (e.g. UCSC)	None

Methodology

Replicates	ChIP-Seq was performed in an n of 1 for 200 pooled DRGs from 50 mice.
Sequencing depth	The sequencing depth for both Input and IP was 3G. The library products corresponding to 200-500 bps were enriched, quantified and finally sequenced on Novaseq 6000 sequencer (Illumina) with PE150 model. The total number of reads was 20817882 and 27254598 for DRGZFP612_Input and DRGZFP612_IP and the uniquely mapped reads was 3712584 and 2581672 for DRGZFP612_Input and DRGZFP612_IP respectively.
Antibodies	A rabbit anti-ZFP612 (Proteintech, 21322-1-AP) was used for ChIP-seq.
Peak calling parameters	Read mapping was performed with bowtie2 version 2.4.2 and the Peak calling was performed with MACS version 2.2.7.1 using default parameters.
Data quality	FastQC (version 0.11.5) was used for sequencing quality control. Raw sequencing data was first filtered by Trimmomatic (version 0.36), low-quality reads were discarded and the reads contaminated with adaptor sequences were trimmed.
Software	FastQC version v0.11.5, Trimmomatic version 0.36, Bowtie2 version v2.4.2, STAR version 2.5.3a, RSeQC version 2.6, MACS2 version 2.2.7.1, Bedtools version v2.25.0, Homer version v4.11, Kobas version 2.1.1, Igraph (R package) version 1.0.0.