nature portfolio

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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	The following software were used for data collection: -Q-Rex Software (Qiagen) -PROMO (version 8.3 of TRANSFAC) -Image J software, version v.1.8.0_172 (NIH) -Zen 2.3 software (Carl Zeiss)
Data analysis	The following software were used for data analysis: -Q-Rex Software (Qiagen) was used for data analysis of quantitative PCR. -Zen 2.3 software (Carl Zeiss) was used to analyze immunofluorescent images. -Image J software (NIH) was used for quantitative analysis of western blots. -GraphPad Prism (version 6.0) was used of statistical analysis of all data.

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 source data for all figures, and supplementary figures are available as a Source Data file. Reporting Summary for this article is provided as Supplementary Information file.

Human research participants

Policy information about studies involving human research participants and Sex and Gender in Research.

Reporting on sex and gender	N/A
Population characteristics	N/A
Recruitment	N/A
Ethics oversight	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	Samples sizes were determined based on previous experience, literature standards, and pilot data. Additional details regarding sample size can be found in Source Data associated with each figure.
Data exclusions	No samples or animals were excluded from analyses.
Replication	All experimental findings were reproduced independently at least four times. For each figure panel, the numbers of biologically independent samples and mice per group are indicated in the figure legends. Data shown in figure panels are the mean of all independent biological repeats. Western blot pictures, confocal microscopy images, or histological images are typically taken from representative experiments; however, the number of independent repeats is clearly indicated in the figure legends and all attempts at replication were successful.
Randomization	For in vitro experiments, cultures were randomly chosen for different treatments and experiments were performed multiple times. For in vivo experiments, mice were allocated into groups based on sex, age, and genotype, and female mice were mated with male mice of the corresponding genotypes. Pregnant mice were randomly divided into each experimental group through the double blind.
Blinding	The investigators were blinded to allocation during experiments and outcome analyses.

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

The following primary and secondary antibodies were used in western blotting and immunohistochemistry: Antibodies against PlGF (sc-518003, 1:1000) and Twist1 (sc-81417, 1:1000) were purchased from Santa Cruz Biotechnology. Antibodies for HIF-1alpa (MAB1536, 1:1000), p-VEGFR-1 (AF4170, 1:1000), and human VEGF (neutralizing, MAB293) were purchased from R&D Systems. Antibody for VEGFR-1 (2893, 1:1000) was purchased from Cell Signaling Technology. Antibodies for eNOS (61029700. 1:1000), Dnm3 (14737-1-AP, 1:1000), and beta-actin (A5441, 1:5000) were purchased from BD Biosciences, Proteintech, and Sigma-Aldrich, respectively. Antibodies for cytokeratin (1:100; ab9377, Abcam), CD31 (1:100; MA3105, Invitrogen), alpha-SMA (1:100; M0851, Dako), IgG-Alexa Fluor 488 (1:400; A21206, Invitrogen), IgG-Alexa Fluor 647 (1:400; ab173004, Abcam), and IgG-Alexa Fluor 555 (1:400; A21427, Invitrogen) were used for immunohistochemical staining.

Validation

All the antibodies were validated for the species (human or mouse) and applications (western blotting or immunohitochemistry) by the correspondent manufacturer, which is described in the manufacturer's website.

Eukaryotic cell lines

Policy information about cell lines and Sex and Gender in Research

Cell line source(s)

HTR-8/SVneo cells (ATCC® CRL3271™) and BeWo cells (KCLB No. 10098) were purchased from the American Type Culture Collection (Maryland, USA) and the Korean Cell Line Bank (Seoul, South Korea), respectively. Human umbilical vein endothelial cells (8000) and human aortic smooth muscle cells (6110) were purchased from ScienCell Research Laboratories.

Authentication

Not authenticated

Mycoplasma contamination

Not tested

Commonly misidentified lines
(See ICLAC 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

Wild-type C57BL/6 mice were purchased from Orient Bio Inc. (Seongnam, South Korea). MiR-214-3p KO mice were generated by Dr Shim (Chungbuk National University, South Korea). Mice were housed in a controlled environment (temperature, 18–24°C; humidity, 30–50%) with a 12-h light:12-h dark cycle and provided free access to standard food (A Bio, South Korea) and water in a pathogen-free animal facility.

Wild animals

This study did not use wild animals.

Reporting on sex

Pregnant wild-type and miR-214-3p knockout mice (C57BL/6), aged 7 to 8 weeks, were used as a mouse model of preeclampsia. In addition, 7 to 8-week-old female C57BL/6 mice were used for isolation of lung endothelial cells.

Field-collected samples

This study did not use samples collected from the fields.

Ethics oversight

All procedures of animal care and use in this study were approved by the Animal Ethics Committee of Kangwon National University (approval number KW-200305-3).

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