

Reporting Summary

Nature Research 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 Research 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

Custom code was used for data collection. All the plots were drawn using Prism8(Ver.8.2.1). Rhinoceros(Ver.5.3.2) and Adobe illustrator(24.0.3) were used for figures and schematics. COMSOL Multiphysics (Ver5.4) was used for simulations. The live-cell area was quantified using Image J(Ver.1.52r). The custom code is available from the following link (https://github.com/jaelee2020/suturable_fibre_strain_sensors.git)

Data analysis

No commercial, open source nor custom code used for data analysis except Excel(Ver.16.45)-based basic data analysis. (Sum, average, etc.)

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 Research [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 list of figures that have associated raw data
- A description of any restrictions on data availability

The data that support the plots within this paper and other findings of this study are available from the corresponding author upon reasonable request.

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://www.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	The sample size was chosen to be 1 to validate the functionality of the suturable fibre strain sensing system as a proof-of-concept experiment. The sample size for the in-vivo demonstration was determined to be sufficient because the results were reproducible and the animal experiments were intended to demonstrate device capabilities.
Data exclusions	No data exclusions
Replication	All replications of the ex-vivo and in-vivo demonstrations performed independently (ex-vivo: 2 times, in-vivo: separate 6 samples) were successful when following the experimental procedure described in the paper. All replications of the sensor fabrication over 50 times were fully successful based on the fabrication process described in the paper.
Randomization	Randomization was not relevant to our study. All the sensors tested in vitro and in vivo were fabricated following the same fabrication process as described in the paper.
Blinding	A blinding process is not relevant because it would not influence the result.

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
☒	☐ Human research participants
☒	☐ Clinical data
☒	☐ Dual use research of concern

Methods

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

Eukaryotic cell lines

Policy information about [cell lines](#)

Cell line source(s)	HMVEC-C – Human Cardiac Microvascular Endothelial Cells, Supplier: Lonza, Catalogue number: CC-7030
Authentication	Cells were isolated from normal, adult heart tissue by a supplier (Lonza) and the cryopreserved cells were shipped at passage 3. None of the cell lines were authenticated by authors.
Mycoplasma contamination	The cell lines were tested by a supplier (Lonza) before shipment and they were negative for Mycoplasma contamination. Additional tests were not conducted by authors but no identification of contamination was observed.
Commonly misidentified lines (See ICLAC register)	None used

Animals and other organisms

Policy information about [studies involving animals](#); [ARRIVE guidelines](#) recommended for reporting animal research

Laboratory animals	The study animals were 2 SPF(specific pathogen free) swine weighing 30-35kg. species: KSP, age:10-12 months, male and female for each
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Wild animals	No wild animals were used in the study.
Field-collected samples	No field collected samples were used in the study
Ethics oversight	The animal study was approved by the KRIBB (Korea Research Institute of Bioscience & Biotechnology) Institutional animal care and use committee (Approval No. KRIBB AEC-20150) and conformed with the Guide for the Care and Use of Laboratory Animals published by the United States National Institutes of Health (NIH Publication No. 85-23, revised 1996).

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