

Life Sciences Reporting Summary

Nature Research wishes to improve the reproducibility of the work that we publish. This form is intended for publication with all accepted life science papers and provides structure for consistency and transparency in reporting. Every life science submission will use this form; some list items might not apply to an individual manuscript, but all fields must be completed for clarity.

For further information on the points included in this form, see [Reporting Life Sciences Research](#). For further information on Nature Research policies, including our [data availability policy](#), see [Authors & Referees](#) and the [Editorial Policy Checklist](#).

► Experimental design

1. Sample size

Describe how sample size was determined.

A sample size of 11 subjects/group was determined by power analysis: 12 animals per group, standard deviation of 0.15, and effect size of 0.24 yields computed power of 0.85. This design is sufficient to determine significant group differences.

2. Data exclusions

Describe any data exclusions.

No data was excluded

3. Replication

Describe whether the experimental findings were reliably reproduced.

In vivo experiments were repeated 3 times and were successful

4. Randomization

Describe how samples/organisms/participants were allocated into experimental groups.

animals were assigned randomly into experimental groups.

5. Blinding

Describe whether the investigators were blinded to group allocation during data collection and/or analysis.

investigators were blinded during behavior data collection.

Note: all studies involving animals and/or human research participants must disclose whether blinding and randomization were used.

6. Statistical parameters

For all figures and tables that use statistical methods, confirm that the following items are present in relevant figure legends (or in the Methods section if additional space is needed).

n/a Confirmed

- ☐ ☒ The exact sample size (n) for each experimental group/condition, given as a discrete number and unit of measurement (animals, litters, cultures, etc.)
- ☐ ☒ A description of how samples were collected, noting whether measurements were taken from distinct samples or whether the same sample was measured repeatedly
- ☐ ☒ A statement indicating how many times each experiment was replicated
- ☐ ☒ The statistical test(s) used and whether they are one- or two-sided (note: only common tests should be described solely by name; more complex techniques should be described in the Methods section)
- ☒ ☐ A description of any assumptions or corrections, such as an adjustment for multiple comparisons
- ☐ ☒ The test results (e.g. P values) given as exact values whenever possible and with confidence intervals noted
- ☐ ☒ A clear description of statistics including central tendency (e.g. median, mean) and variation (e.g. standard deviation, interquartile range)
- ☐ ☒ Clearly defined error bars

See the web collection on [statistics for biologists](#) for further resources and guidance.

► Software

Policy information about [availability of computer code](#)

7. Software

Describe the software used to analyze the data in this study.

JMP Pro, Excel for Mac., ImageJ, Proprietary in-house code for operating the 3D printer.

For manuscripts utilizing custom algorithms or software that are central to the paper but not yet described in the published literature, software must be made available to editors and reviewers upon request. We strongly encourage code deposition in a community repository (e.g. GitHub). *Nature Methods* [guidance for providing algorithms and software for publication](#) provides further information on this topic.

► Materials and reagents

Policy information about [availability of materials](#)

8. Materials availability

Indicate whether there are restrictions on availability of unique materials or if these materials are only available for distribution by a for-profit company.

Scaffold materials were prepared in the lab of Dr. Shaochen Chen and readily available from the authors. One can also purchase the same materials now from commercial vendors such as Thermo Fisher.

9. Antibodies

Describe the antibodies used and how they were validated for use in the system under study (i.e. assay and species).

GFP (Rabbit, Thermo Fisher #6455, 1: 500): Manufacturer's website lists reactivity in rat, 160 references documenting use in immunohistochemistry.
Hu (Human, gifted from Dr Robert Darnell, 1:500): The original paper (Ince-Dunn et. al., Neuron, 2012) validated this antibody and our paper published in Nature Methods (Kamamaru et al (2018).
NeuN (Guinea Pig, Millipore ABN90, 1:500): Manufacturer's website lists reactivity in rat, 1 reference documenting use in immunohistochemistry.
MAP2 (Mouse, clone AP20, BD Biosciences #556320, 1:500): Manufacturer's website lists reactivity in rat, 4 references documenting use in immunohistochemistry.
Neurofilament phosphorylated heavy-chain (NF200, mouse, Millipore MAB5262, 1:500): Manufacturer's website lists reactivity in rat, 16 references documenting use in immunohistochemistry.
5-HT (Goat, Immunostar #20079, 1:500): Manufacturer's website lists reactivity in rat, 160 references documenting use in immunohistochemistry.
GFAP (Chicken, Encor Bio #CPCA-GFAP, 1:500); Manufacturer's website lists reactivity in rat, use in immunohistochemistry in 5 references, including the original 1972 paper (Bignami et al., Brain Res).
Olig2 (Rabbit polyclonal, IBL #18953, 1:500): Manufacturer's website lists reactivity in rat, 6 references documenting use in immunohistochemistry.
S100 (Rabbit polyclonal, Dako Z0311, 1:500): CiteAb.com website lists reactivity in rat and list 318 references documenting use in immunohistochemistry.
Ki67 (Rabbit polyclonal, clone SP6, GeneTex #GTX16667, 1:500): Manufacturer's website lists reactivity in rat, 55 references documenting use in immunohistochemistry.
Nestin (Mouse monoclonal, BD Pharmingen 556309, 1:500): Manufacturer's website lists reactivity in rat, 9 references documenting use in immunohistochemistry.
IBA1 rabbit polyclonal, Wako 019-19741, 1:500): Manufacturer's website lists reactivity in rat, 33 references documenting use in immunohistochemistry.
VGluT2 (Guinea Pig, Millipore #AB2251-l, 1:500): Manufacturer's website lists reactivity in rat. The manufacturer validated this antibody.

10. Eukaryotic cell lines

a. State the source of each eukaryotic cell line used.

Not used

b. Describe the method of cell line authentication used.

Not used

c. Report whether the cell lines were tested for mycoplasma contamination.

Not used

d. If any of the cell lines used are listed in the database of commonly misidentified cell lines maintained by [ICLAC](#), provide a scientific rationale for their use.

Not used

► Animals and human research participants

Policy information about [studies involving animals](#); when reporting animal research, follow the [ARRIVE guidelines](#)

11. Description of research animals

Provide details on animals and/or animal-derived materials used in the study.

Fischer 344 adult rats, 180-200 gr, female, 9 weeks old.

Rat embryonic E14 cells: spinal cords from GFP-expressing E14 F344 embryos were dissected and the meninges removed. The tissue was trypsinized for 15 minutes followed by centrifugation at 2,500 rpm at room temperature. Tissue was resuspended in NeuroBasal medium (Gibco) containing 2% B27 (Gibco), and the spinal cord tissue was gently triturate using progressively smaller fire-polished Pasteur pipets. Cells were then centrifuged at 2,500 rpm for 2 min, resuspended in NeuroBasal medium containing B27, and filtered using 40µm cell filter strainer.

Policy information about [studies involving human research participants](#)

12. Description of human research participants

Describe the covariate-relevant population characteristics of the human research participants.

Human spinal cord images were taken from a database. The only criteria was ASIA-A grade patients . T1 and T2 weighted images were obtained.