

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	Primary data (digital confocal laser-scanning micrographs) were collected using the Leica LAS X v3.1.5 software (Leica Microsystems, Wetzlar, Germany) that comes as the standard software for controlling advanced Leica microscopes.
Data analysis	Original micrographs were processed with ImageJ v1.53, https://imagej.nih.gov/ij/ . Overall fluorescence intensities in defined parts of the images were quantified with Leica LAS X v3.1.5 (Leica Microsystems, Wetzlar, Germany). MP4-versions of the supplementary videos were produced with QuickTimePro v7.7.9 (https://support.apple.com/downloads/quicktime). B-spline interpolations, numerical derivation, and regressions in the analysis of wave kinetics were performed with TableCurve2D (Systat Software, San Jose CA, USA). The algorithm created for determining average fluorescence intensities at defined distances from the point of impact is available at https://github.com/patrickmcgreevy/geco_data_processing.git . References. Statistical tests (Student's t-tests) were performed using Vassarstats on vassarstats.net .

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 used for producing the figures in the main paper are available in the 'Source_Data' Excel file submitted. All data used for producing the Supplementary Figures are found in the 'Supplementary_Data' Excel file that is included with the supplemental materials. Additional videos of calcium responses are available at <https://doi.org/10.5281/zenodo.6909354>.

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](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

No formal pre-determination of sample sizes was attempted because, first, the experiments initially had an exploratory character, and second, most comparisons were qualitative (e.g., "fast wave" present or not?). For the quantitative comparison of the propagation rates of slow and fast waves (Fig. 2c), we aimed at 8-10 independent repetitions for each treatment (different calcium sensors, cantilever or pressure-probe tests), and did not increase these sample sizes because statistical testing indicated that the two wave types differed at $p < 0.0001$ for every treatment (compare Fig. 2c).

Data exclusions

Data (individual video files) were excluded only when technical issues, which unavoidably occurred in a fraction of the experiments (such as a spontaneous movement of the leaf out of the range in which the focal plane could be adjusted), made further analyses impossible.

Replication

All experiments were successfully repeated in multiple leaves (technical replicates) of several individual plants (biological replicates); the exact numbers of technical and biological replicates for each experiment reported are given in the figure legends and the main text.

Randomization

Plants for experiments were chosen randomly from large numbers of individuals cultivated together using the same equipment.

Blinding

Blinding was not performed. All plant lines used showed the same phenotype and thus were indistinguishable, and since the different results (slow wave only versus slow wave followed by fast wave) occurred in an essentially unpredictable manner in all plants, there was no possible experimenter's bias that could have been eliminated by blinding. Other comparisons analyzed in this study concerned potential differences between different fluorophores used and mechanostimulations applied (cantilever versus pressure-probe). It is impossible to conduct these experiments while blinded for the techniques used.

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	Involvement in the study
☒	☐ Antibodies
☒	☐ Eukaryotic cell lines
☒	☐ Palaeontology and archaeology
☒	☐ Animals and other organisms
☒	☐ Clinical data
☒	☐ Dual use research of concern

Methods

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