

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	PyCorder V1.0.9 (Brain Products GmbH) was used for electrophysiological data collection. BZ-X Viewer v.1.03 (Keyence) was used for histological data collection.
Data analysis	MATLAB 2007b, 2022a, 2023a (The Mathworks) and MATLAB FieldTrip toolbox (Oostenveld et al., 2011) were used for electrophysiological analyses. DeeplabCut v 2.2 (Mathis, A. et al., 2018) and MATLAB 2022a were used for behavioural analyses. ImageJ 1.54f (Wayne Rasband, US National Institutes of Health, rsb.info.nih.gov/ij/) was used for histological analyses.

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](#)

Data availability: The primary data described in the manuscript are available online at <https://doi.org/10.6084/m9.figshare.26013223>. 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	n/a
Reporting on race, ethnicity, or other socially relevant groupings	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 statistical methods were used to predetermine sample sizes. The number of monkeys and experimental days were similar to those reported in other studies with the chemogenetic blockade in macaques (e.g. Kinoshita et al. 2012; Tohyama et al. 2017; Nagai et al. 2020). The number of trials in the electrophysiological experiments were similar to those reported in previous studies (e.g. Sawada et al. 2015; Chao et al. 2019)
Data exclusions	The drop error trials (in which the monkeys dropped the food and failed to eat it) and wandering error trials (in which both fingers touched the food, but the monkeys released it and tried to pick it up again) were excluded from the electrophysiological analyses.
Replication	Results of both behavioural and electrophysiological experiments were replicated across two subjects.
Randomization	The two monkeys are not allocated and they underwent the same experimental procedures. In both monkeys, DCZ or vehicle were used in different days. The order of drug administration was not random. Instead, the administration days of DCZ and vehicle were alternated as much as possible to control the influence of the degree of recovery on the results.
Blinding	The behavioural analyses were performed in a blinded fashion. The electrophysiological analyses were performed automatically by using the same MATLAB code across experimental days.

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	Rabbit anti-RFP antibody (Rockland Immunochemicals, Inc., 600-401-379, polyclonal, Lot 42896) Biotinylated goat anti-rabbit IgG antibody (Vector Laboratories, BA-1000, polyclonal, Lot ZE0730)
Validation	All the antibodies were validated by manufacturer. Rabbit anti-RFP antibody: https://www.rockland.com/categories/primary-antibodies/rfp-antibody-pre-adsorbed-600-401-379/ Biotinylated goat anti-rabbit IgG antibody: https://vectorlabs.com/products/antibodies/biotinylated-goat-anti-rabbit-igg

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	The four Japanese monkeys (<i>Macaca fuscata</i>) participated in the experiments (Monkey A [5 years, male], Monkey H [7 years, female], Monkey I [6 years, female] and Monkey K [6 years, female])
Wild animals	n/a
Reporting on sex	No sex- and gender-based analyses have been performed due to the limitation of the number of animals. Both male and female monkeys participated in this study and the results were consistent across sex.
Field-collected samples	No field collected samples were used in this study.
Ethics oversight	All experimental procedures and animal care were performed in accordance with the ILAR's Guide for the Care and Use of Laboratory Animals and were approved by the Committee for Animal Experiments at the Graduate School of Medicine in Kyoto University, Japan.

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