Research Transparency and Reproducibility

Research articles should contain sufficient information to allow others to verify and replicate new findings. Therefore:

1. Authors must make resources such as data, materials, protocols and software code available to readers without undue barriers to access.
2. Any restrictions on resource availability must be disclosed in the published article.

Authors should also adhere to any additional requirements that may apply to them in the policies of their research funders and host institutions.

When and how resources should be made available

All resources should be available to peer-reviewers with the exception of physical materials such as cell lines. Resources should be made publicly accessible by the time of publication.

There are three ways in which resources can be made available:

1. **In the article.**
   Data and methods can be included in the journal article itself.
2. **As supplementary information.**
   Resources that do not fit within the journal article itself can be included in supplementary information files. These will be available to peer-reviewers but will not be copy edited or otherwise modified before publication. See *Supplementary information files*, below, for more information.
3. **Deposition in community resources.**
   Resources that cannot reasonably be put into supplementary information files (for example because they are too large) should be placed in appropriate external repositories. See *Repositories*, below, for more information.

Any restrictions on the availability of resources must be reasonable, such as through material transfer agreements or charges applied to cover distribution costs. If resources are commercially distributed, then this should be indicated in the published article.

Sensitive and confidential information

Some resources might not be possible to share publicly. As far as possible, these resources should be made available to appropriate researchers via a managed application processes. In some cases it may be acceptable for resources to be made available to peer-reviewers but not to others.

Articles should not include sensitive information, for example personally identifiable data. De-identified data should be provided as far as that is safe and practical to do. If that is not possible, aggregated data derived from sensitive data should be provided.

With reasonable exceptions, the findings of research articles should not be based upon proprietary code or other commercially sensitive materials and products that cannot be shared or distributed in any circumstance. Legal protections can be applied to prevent misuse of these resources, allowing the resources to be made available to other researchers.

Data manipulation

Articles should provide full details about how data was processed. Data processing should never attempt to hide or obscure anything that might call the interpretation of the data into question.

Data behind figures

The data used to create graphs and other figures should be available to readers to allow further analysis. For example, the numerical values plotted in a graph can be provided as a spreadsheet in the Supplementary Information, or a spreadsheet can be included as an alternative version of the figure (alongside, for example, high and low resolution versions of an image). See also *Guidelines for spreadsheets*, below, for more information.

Images

Original versions of images that have been edited or processed for a journal article should also be accessible in their original form. This is particularly important when an image is processed to highlight or extenuate a particular feature, as the original data allows readers validate the appropriateness of the image processing and the interpretation of the results.

Statistics

Good reporting of statistical parameters and tests is critical for evaluating the reliability of research findings. Authors should specify key information such as sample sizes, the statistical tests used and the basis for their interpretation. As well as reporting the number and type of replications within an experiment, the article should report how many times an experiment was replicated.

Supplementary information files

Supplementary information files are not edited or otherwise modified by the journal. Authors should include any information that will be required by others to allow them to access, interpret and process the files.

In general there are no rules for what types of data or formats should be used. Open, standardized file formats are preferred to proprietary formats, though commonly used or ubiquitous proprietary file formats are equally acceptable.

The file format should be appropriate for the data it contains. For example, data tables should not be provided as PDFs, but as spreadsheets or tabular text formats. See *Guidelines for spreadsheets*, below for more information.

Guidelines for spreadsheets

The following recommendations will help readers to make use of spreadsheets and other tabular formats, particularly for large amounts of data:

- Avoid having more than one data table in each spreadsheet. Put separate tables into a separate spreadsheet.
- Put each type of data element into its own column, instead of having a column contain more than one type of data element.
- Avoid, as far as is practical, merging spreadsheet cells. Merged cells are acceptable, though still undesirable, in header rows but are not appropriate in data rows.
- Do not intersperse comment lines or other annotations amongst the data rows. Keep annotations such as abbreviation keys in a header row of the table, or in their own column, or in separate annotations file.
- Try to express units (such as physical quantities) in a way that helps further data processing. For example, either include units in a header row or, if they vary through the data, put units in their own column.

Repositories

Data and other information can be hosted in repositories that:

- Are committed to the long term preservation and accessibility of their content.
- Are supported and recognized by the community as appropriate for the resources they hold.
- Provide stable, unique identifiers for the information they hold.
- Support linking between their database records and associated published research articles.
- Allow free public access to their holdings, with reasonable exceptions (such as administration charges for the distribution of physical materials).

Author's personal or departmental websites do not meet these requirements.

Specialized repositories that are recognized by the academic community as key tools for particular types of data should be used whenever possible. Generalist repositories, which can host a wide variety of data types, should be used if no specialized repository exists: examples are Dryad, Zenodo, Dataverse and FigShare.

Readers encountering problems with accessing resources

A reader who encounters a problem accessing resources in line with the journal's sharing policy should contact the Editor-in-Chief or Cambridge University Press. In extreme cases, the journal may apply a correction or notice to an article concerning the non-availability of resources.