

PNAS Information for Authors

REVISED January 2017

PNAS authors, editors, and reviewers come from around the globe. Submissions are welcomed from all researchers. Authors do not need to have a connection to an NAS member to publish in PNAS. More than 75% of published papers are submitted directly to PNAS, not Contributed papers by NAS members. To make its coverage more representative of the disciplines that comprise the National Academy of Sciences, PNAS has issued a [Call for Papers in the Physical and Social Sciences](#).

Accepted papers must be of exceptional scientific importance and intelligible to a broad scientific audience. An NAS member makes the final decision for each paper.

PNAS is committed to [transparency in its editorial review process](#) (see our [FAQ for authors](#)). PNAS is a member of the [Committee on Publication Ethics \(COPE\)](#) and subscribes to its principles.

PURPOSE AND SCOPE

PNAS publishes research reports, Letters, Front Matter, Commentaries, Perspectives, and Colloquium Papers. In accordance with the guiding principles established by George Ellery Hale in 1914, PNAS publishes brief first announcements of Academy members' and foreign associates' more important contributions to research and of work that appears to a member to be of particular importance. PNAS is a general science journal and all papers should be intelligible to a broad scientific audience.

Research Reports describe the results of original research of exceptional importance. Each research article is published with a brief, author-written Significance Statement that describes the significance of the work. Unsolicited research reports are welcome.

Letters are brief online comments that allow readers to constructively address a difference of opinion with authors of a recent PNAS article. Readers may comment on exceptional studies or point out potential flaws in studies published in the journal. Letters may not include requests to cite the Letter writer's work, accusations of misconduct, or personal comments to an author. Letters are limited to 500 words and 10 references, and must be submitted within 6 months of the online publication date of the subject article. Unsolicited Letters are welcome.

Front Matter is an expanded front section aimed at a more general level of discussion, tackling the stories of science in interesting ways. Sections include Opinions, News Features, Science and Culture, Inner Workings, and Core Concepts. Front Matter is written only at the invitation of the Editorial Board.

Commentaries call attention to papers of particular note and are written only at the invitation of the Editorial Board.

Perspectives present a viewpoint on an important area of research. Perspectives focus on a specific field or subfield within a larger discipline and discuss current advances and future directions. Perspectives are of broad interest to nonspecialists and may add personal insight to a field. Perspectives are written only at the invitation of the Editorial Board.

Colloquium Papers are reports of scientific colloquia held under Academy auspices and are written only at the invitation of the Editorial Board.

EDITORIAL POLICIES

All articles are evaluated solely on their scientific merit by peers, not by professional staff editors. A three-tier review process for research reports includes an Editorial Board member from one of the 31 NAS disciplines, an NAS Member Editor, and independent peer reviewers. NAS Member Editors are professional scientists and active researchers. A full list of Editorial Board members and their disciplines is included in our [masthead](#).

Submission Guidelines

Direct Submission. The standard mode of transmitting manuscripts is [Direct Submission](#). Direct Submissions account for more than 75% of papers published in PNAS and do not need to be sponsored by an NAS member. The Editorial Board screens all incoming submissions and may reject manuscripts without further review, or review and reject manuscripts that do not meet PNAS standards. More than 50% of Direct Submissions are declined by the Editorial Board without additional review, which takes less than 2 weeks on average. For papers that are sent on to an editor and reviewers, the average time to receive a decision is 41 days. If accepted, authors have their papers published online as soon as 4–5 weeks after acceptance. Authors must recommend three appropriate Editorial Board members, three NAS members who are expert in the paper's scientific area, and five qualified reviewers. The Board may choose someone who is or is not on that list or may reject the paper without further review. Authors are encouraged to indicate in their cover letter why their suggested editors are qualified to handle the paper. A directory of PNAS Member Editors and their research interests is available within the submission process and at nrc88.nas.edu/pnas_search. The editor may obtain reviews of the paper from at least two qualified reviewers, each from a different institution and not from the authors' institutions. The PNAS Office will invite the reviewers, secure the reviews, forward them to the editor, and secure any revisions and subsequent reviews. The name of the editor must remain anonymous to the author until the paper is accepted. Direct Submissions are published as "Edited by" the responsible editor and have an identifying footnote.

Contributed Submission. Less than 25% of published research papers are Contributed submissions by NAS members. An Academy member may submit up to four of his or her own manuscripts for publication per year. The deadline is the last day of the year. To contribute an article, the member must affirm that he or she had a direct role in the design and execution of all or a significant fraction of the work, and the subject matter must be within the member's area of expertise. Contributed articles must report the results of original research. A footnote will be included on Contributed papers for which the member or coauthors disclose a significant financial or other competing interest. When submitting using the Contributed process, members must secure the comments of at least two qualified reviewers, each from a different institution and not from the authors' institutions. Reviewers should be asked to evaluate revised manuscripts to ensure that their concerns have been adequately addressed. Members' submissions must be

accompanied by the names and contact information, including emails, of knowledgeable experts who reviewed the paper, along with all of the reviews received and the authors' response for each round of review, and a brief statement endorsing publication in PNAS. Reviews must be on the PNAS review form. Members must select reviewers who have not collaborated with the authors in the past 48 months. See section *iv* and the [Conflict of Interest Policy](#). Members must verify that reviewers are free of conflicts of interest, or must disclose any conflicts and explain their choice of reviewers. Members may choose to have the administrative aspects of the review process for Contributed articles handled by the PNAS Editorial Office until January 2017, when this process becomes mandatory. Members who have selected reviewers should submit information about their manuscript at www.pnascentral.org, including a PDF file for review, and documentation that the reviewers have agreed to review the paper. Members make the decision to submit the final version, revise, or withdraw their paper. The names and institutional affiliations of all reviewers of Contributed papers are published in a footnote. The Academy member must be one of the corresponding authors on the paper. These papers are published as "Contributed by" the responsible editor.

PNAS Plus. Authors may submit a [PNAS Plus](#) version of either a Direct or Contributed Submission, in which research reports appear in an expanded online format up to 10 pages in length. A collection of PNAS Plus Significance Statements is published in each issue.

All manuscripts are evaluated by the Editorial Board. The identity of the assigned Board member is confidential and not shared with authors or third parties. The names of reviewers are confidential and not shared, unless express permission is granted by the reviewers. The Board may reject manuscripts without further review, or review and reject manuscripts that do not meet PNAS standards. Replication studies are held to the same standards as other submissions. Manuscripts rejected by one member cannot be resubmitted through another member or as a Direct Submission. Please note a single negative review, with which the editor agrees, is sufficient to recommend rejection. Revised papers must be received within 2 months of the decision notification or they will be treated as new submissions. Information pertaining to a submitted manuscript is treated as confidential and not shared outside of the journal.

Appeals of decisions on rejected papers will be considered; however, appeals on the basis of novelty or general interest are unlikely to be granted. Due to the high volume of submissions that PNAS receives we cannot guarantee a quick decision on appeals. Appeals must be made in writing and should be sent to pnas@nas.edu. If an appeal is rejected, further appeals of the decision will not be considered and the paper may not be resubmitted. **Repeated appeals or resubmissions of a rejected manuscript without invitation by the Editorial Board will not be considered and may result in the authors being banned from submitting to PNAS.**

Journal Policies

(i) Articles are considered provided they have not been **Published Previously** or concurrently submitted for publication elsewhere. What constitutes prior publication must take into account many criteria, including the extent of review, and will be determined on a case-by-case basis. Related manuscripts that are in press or submitted elsewhere must be included with a PNAS submission.

Figures, tables, or videos that have been published elsewhere must be identified, and permission of the copyright holder for both the online and print editions of the journal must be provided (see www.pnas.org/site/misc/permissions_letter.pdf).

(ii) Posting to **Preprint Servers**, such as arXiv or bioRxiv, is permitted, but authors must retain copyright of their work and limit reuse to be consistent with the [PNAS License to Publish](#). Creative Commons licenses are not compatible with the PNAS License. See the [PNAS statement](#) on prior publication for details, and see section *vii* for media embargo policies.

(iii) **Authorship** must be limited to those who have contributed substantially to the work. The corresponding author must have obtained permission from all authors for the submission of each version of the paper and for any change in authorship.

All collaborators share some degree of responsibility for any paper they coauthor. Some coauthors have responsibility for the entire paper as an accurate, verifiable report of the research. These include coauthors who are accountable for the integrity of the data reported in the paper, carry out the analysis, write the manuscript, present major findings at conferences, or provide scientific leadership to junior colleagues. Coauthors who make specific, limited contributions to a paper are responsible for their contributions but may have only limited responsibility for other results. While not all coauthors may be familiar with all aspects of the research presented in their paper, all collaborators should have in place an appropriate process for reviewing the accuracy of the reported results. Authors must indicate their specific contributions to the published work. This information will be published as a footnote to the paper. Examples of designations include:

- Designed research
- Performed research
- Contributed new reagents or analytic tools
- Analyzed data
- Wrote the paper

An author may list more than one contribution, and more than one author may have contributed to the same aspect of the work.

(iv) Failure to disclose a **Conflict of Interest** at submission may result in author sanctions. Authors must disclose, at submission, any association that poses or could be perceived as a conflict of interest in connection with the manuscript, and acknowledge all funding sources supporting the work. When asked to evaluate a manuscript, members, reviewers, and editors must disclose any association that poses a conflict of interest in connection with the manuscript. Recent collaborators, defined as people who have coauthored a paper or were a principal investigator on a grant with any of the authors within the past 48 months, must be excluded as editors and reviewers. Other examples of possible conflicts include past or present association as thesis advisor or thesis student, or a family relationship, such as a spouse, domestic partner, or parent-child relationship. Please see the [Conflict of Interest Policy](#) for details.

(v) Regarding **Research Misconduct**, all work should be free of fabrication, falsification, and plagiarism as defined by the [US Office of Research Integrity](#).

(vi) Completion of the online submission form electronically gives an exclusive **License to Publish** the work to the National Academy of Sciences. If university or other institutional restrictions might limit the authors' ability to grant to NAS any of the rights described in the **License to Publish**, the authors must obtain a waiver from their institution. If a paper is declined for publication, the license to publish is terminated.

(vii) The Academy may distribute **Embargoed** copies of an accepted article to the press prior to publication. Embargoes expire at 3:00 PM Eastern time, Monday of the publication week. Authors may talk freely with the press about their work but should coordinate with the PNAS News Office so that reporters are aware of PNAS policy. If a version of your PNAS manuscript has ever been posted, in whole or in part, in any publicly accessible form, including at preprint servers, or if you plan

on presenting your embargoed paper at a conference prior to publication, please note that different embargo policies may apply and authors must contact the PNAS News Office immediately at 202-334-1310 or PNASnews@nas.edu.

(viii) Research involving **Human and Animal Participants** and **Clinical Trials** must have been approved by the author's institutional review board. Authors must include in the methods section a brief statement identifying the institutional and/or licensing committee approving the experiments. For all experiments involving human participants, authors must also include a statement confirming that informed consent was obtained from all participants, or provide a statement why this was not necessary. All experiments must have been conducted according to the principles expressed in the [Declaration of Helsinki](#). Authors must follow the [International Committee of Medical Journal Editors' policy](#) and deposit trial information and design into an accepted clinical trial registry before the onset of patient enrollment. For animal studies, authors must report the species, strain, sex, and age of the animals.

(ix) **Dual Use Research of Concern**. Authors and reviewers must notify the Editor-in-Chief if a manuscript reports potential dual use research of concern. The Editor-in-Chief will evaluate potential dual use research of concern papers and, if necessary, will consult additional reviewers.

(x) For research using **Recombinant DNA**, physical and biological containment must conform to [National Institutes of Health guidelines](#) or those of a corresponding agency.

(xi) **Materials and Data Availability**. To allow others to replicate and build on work published in PNAS, authors must make materials, data, and associated protocols, including code and scripts, available to readers. Authors must disclose upon submission of the manuscript any restrictions on the availability of materials or information. Authors must include a data availability statement in the methods section describing how readers will be able to access the data, associated protocols, code, and materials in the paper. Data not shown and personal communications cannot be used to support claims in the work. Authors are encouraged to use supporting information (SI) to show all necessary data or to deposit as much of their data as possible in community-endorsed publicly accessible databases, and when possible follow the guidelines of the [Joint Declaration of Data Citation Principles](#). Research datasets should be cited in the references if they have a digital object identifier (DOI). (See *References* for citation information.) Such deposition may facilitate access to data during the review process and postpublication. In rare cases where subject specific repositories are not available, authors may use [figshare](#) or [Dryad](#). Fossils or other rare specimens must be deposited in a museum or repository and be made available to qualified researchers for examination. For further information about accessibility of data and materials, see the following: *Sharing Publication-Related Data and Materials: Responsibilities of Authorship in the Life Sciences* (2003); and *Ensuring the Integrity, Accessibility, and Stewardship of Research Data in the Digital Age* (2009).

Authors must make **Unique Materials** (e.g., cloned DNAs; antibodies; bacterial, animal, or plant cells; viruses; and algorithms and computer codes) promptly available on request by qualified researchers for their own use. Failure to comply will preclude future publication in the journal. It is reasonable for authors to charge a modest amount to cover the cost of preparing and shipping the requested material. Contact pnas@nas.edu if you have difficulty obtaining materials.

Plasmids: Authors are encouraged to deposit plasmid constructs in a public repository such as [Addgene](#).

Databases: Before publication, authors must deposit large datasets (including microarray data, protein or nucleic acid

sequences, and atomic coordinates for macromolecular structures) in an approved database and provide an accession number for inclusion in the published paper. When no public repository exists, authors must provide the data as SI online or, in special circumstances when this is not possible, on the author's institutional website. Authors should contact the editorial office regarding special circumstances or privacy concerns.

Characterization of Chemical Compounds: Authors must provide sufficient information to establish the identity of a new compound and its purity. Sufficient experimental details must be included to allow other researchers to reproduce the synthesis. Characterization data and experimental details must be included either in the text or in the SI.

Protein and Nucleic Acid Sequences: Authors must deposit data in a publicly available database such as [GenBank](#), [EMBL](#), [DNA Data Bank of Japan](#), [UniProtKB/Swiss-Prot](#), or [PRIDE](#).

Structural Studies: For papers describing structures of biological macromolecules and small molecules, the atomic coordinates and the related experimental data (structure factor amplitudes/intensities and/or NMR restraints) must be deposited at a member site of the [Worldwide Protein Data Bank](#): [RCSB PDB](#), [PDBe](#), [PDBj](#), or [BMRB](#). The PDB ID should be included in the manuscript. For nuclear magnetic resonance structures, data deposited should include resonance assignments and all restraints used in structure determination and the derived atomic coordinates for both an individual structure and a family of acceptable structures. Articles must include literature references for all coordinate datasets as well as dataset identification. Authors must agree to release the atomic coordinates and experimental data when the associated article is published. Authors may be asked to provide the atomic coordinates and experimental data during the review process. Questions relating to depositions should be sent to deposit@wwpdb.org.

For papers describing structures of biological macromolecules from electron microscopy experiments that involve any averaging method (including subtomogram averaging), the 3D map should be deposited at either the EMBL-EBI (UK) or RCSB (USA) [EMDB deposition site](#). Any atomic structure models fitted to EM maps must be deposited in the PDB. For electron tomographic studies with no averaging, deposition of one or more representative tomograms in EMDB is strongly recommended. PDB and/or EMDB accession codes must be included in the manuscript, together with a brief descriptive title for each accession. In cases where PDB models have been fitted into EMDB maps, the correspondences between them should be clearly stated.

For papers describing small-angle scattering experiments, authors are encouraged to follow the guidelines presented by the [International Union of Crystallography \(IUCr\)](#). Prior to submission, authors are encouraged to use the [International Union of Crystallography \(IUCr\) checkCIF service](#) to validate their crystallographic information files (CIFs) and structure factors. Validation reports may be submitted as SI for editors and reviewers.

Functional Magnetic Resonance Imaging (fMRI) Studies: Authors should deposit data with the [SumsDB](#), [XNAT Central](#), or other suitable public repositories.

Genomic and Proteomic Studies: Authors of papers that include genomic, proteomic, or other high-throughput data are required to submit their data to the NCBI gene expression and hybridization array data repository ([GEO](#)) or equivalent publicly accessible database and must provide the accession number. Deposition in [dbGaP](#) is encouraged. Access to the deposited data must be available at the time of publication. Submitted data should follow the [MIAME checklist](#).

Enzymology Data: Authors are encouraged to follow the Standards for Reporting Enzymology Data (STRENDA) commission guidelines when reporting kinetic and equilibrium binding data. See the [Beilstein Institut/STRENDA commission website](#) for details.

Earth and Spaces Sciences Data: Authors are encouraged to store data in community-approved public repositories to ensure long-term preservation and accessibility.

Design and Analysis Transparency: Authors should follow field standards for disclosing key aspects of research design and data analysis, and should report the standards used in their study. See the [Equator Network](#) for information about standards across disciplines. Where appropriate, PNAS encourages authors to preregister their studies and analysis plans and to provide links to the preregistration in their submission.

Statistical Analysis: Authors should include the source and version of any software used, full information on the statistical methods and measures used, such as a statistical test, estimates of parameters, sample sizes, and measures of evidence strength (frequentist or Bayesian). Statistical analyses should be done on all available data and not just on data from a “representative experiment.” Statistics and error bars should only be shown for independent experiments and not for replicates within a single experiment (see Figure Legends for error bar details). Editors may send manuscripts for statistical review.

(xi) **Figure Preparation.** No specific feature within an image may be enhanced, obscured, moved, removed, or introduced. The grouping or consolidation of images from multiple sources must be made explicit by the arrangement of the figure and in the figure legend. Adjustments of brightness, contrast, or color balance are acceptable if they are applied to the whole image and if they do not obscure, eliminate, or misrepresent any information present in the original, including backgrounds. Questions about images raised during image screening will be referred to the editors, who may request the original data from the authors for comparison with the prepared figures. If the original data cannot be produced, the manuscript may be rejected. Cases of deliberate misrepresentation of data will result in rejection of the paper and will be reported to the corresponding author’s home institution or funding agency. Authors must obtain consent for publication of figures with recognizable human faces.

(xii) **SI.** SI enhances papers in PNAS by providing additional substantive material, but the paper must stand on its own merits. SI is reviewed along with the paper and must be approved by the editors and reviewers. SI is posted on the PNAS website at the time of publication. SI is referred to in the text and cannot be altered by authors after acceptance.

SI may take the form of supplemental figures, tables, datasets, derivations, and videos. Editors may suggest that part of the submitted data could be more suitably presented online only to save journal space and to focus the article.

(xiv) **PNAS Early Edition (EE).** PNAS articles are published daily online. Papers may be published online 1 to 4 weeks before they appear in an issue. Authors who return proofs quickly and keep changes to a minimum get maximum publication speed. The EE publication date is the official date of record.

(xv) **Open Access.** Papers accepted for publication in PNAS can be made available without cost to the reader immediately upon publication when the authors choose the [open access option](#). All PNAS papers are free online 6 months after publication.

(xvi) **Errata.** PNAS publishes corrections for errors, made by the journal or authors, of a scientific nature that do not alter the overall basic results or conclusions of a published article. PNAS articles may be retracted by their authors or by the editor because of pervasive error or unsubstantiated or irreproducible data.

Articles may be retracted, for example, because of honest error, scientific misconduct, or plagiarism. Errata are published at the discretion of the editors and appear as formal notices in the journal.

PROCEDURES FOR SUBMITTING MANUSCRIPTS

Contact Information. PNAS, 500 Fifth Street, NW, NAS 340, Washington, DC 20001 USA. Phone 202-334-2679, fax 202-334-2739, email pnas@nas.edu.

Publication Fees. PNAS depends, in part, on the payment of publication fees to finance its operations. Articles are accepted or rejected for publication and published solely on the basis of merit. All authors are assessed the following fees:

- *Regular research articles:* \$1,700 per article, with no additional fees for color figures or SI.
- *PNAS Plus articles:* \$2,300 per article, with no additional fees for color figures or SI.
- *Open access:* Authors of research articles may pay a surcharge of \$1,450 to make their paper freely available through PNAS open access option. If your institution has a site license, the open access surcharge is \$1,100. All articles are free online after 6 months.

Publication charges may be paid by credit card, check, or wire transfer. Upon receipt of the publication estimate, authors must log into the author billing system to provide payment arrangements and designate an individual responsible for payment and follow up. For questions regarding billing and payment of fees, email aubilling.djs@sheridan.com, phone 802-560-8518, or fax 802-882-1639. Requests for waiver of charges should be submitted to pnas@nas.edu.

Manuscript Submission

Initial Submission. All authors must submit their articles at www.PNAScentral.org. Only a single PDF file containing all text, figures, tables, and SI is required for initial Direct Submission. High-resolution files are not required for initial submission. The corresponding author must include the following information for each coauthor: author order, first name, last name, email address, and institution. Authors may upload a cover letter (optional), video files, and datasets separately. A length estimate is not required for initial submissions, but 6-page articles should be under 49,000 characters (including spaces, figures, and tables) and 10-page articles under 82,000. PNAS Plus submissions undergo the same review process as Direct Submissions. Authors writing their papers in LaTeX should use our [LaTeX template](#). Authors will need to complete the [License to Publish](#) and provide permissions for any [previously published material](#).

Revised and Contributed Submission. Authors of Contributed papers and authors of revisions or resubmissions must provide publication-ready source files; guidelines for submitting source files appear below. Publication-ready file formats include Word and LaTeX. Only one article text file should be submitted. SI text files should be uploaded separately. Figures and tables should not be included in main or SI text files. Corresponding authors of Contributed papers will be provided a URL for file submission after the member has initiated the process by providing his or her endorsement and copies of the reviews received.

Manuscript Length. PNAS generally uses a two-column format averaging 67 characters, including spaces, per line. The maximum length of a regular research article is 6 pages (or 10 pages for PNAS Plus articles), including all text, spaces, and the number of characters displaced by figures, tables, and equations.

An [online submission tool](#) provides authors with an estimation of whether their manuscript fits within the PNAS length

requirements (see [Length Estimate Guidelines](#) and [FAQ](#)). When submitting tables, figures, and/or equations in addition to text, keep the text for your manuscript under 39,000 characters (including spaces) for 6-page articles and 65,000 for 10-page articles.

Digital Figures. High-resolution figure files are not required for initial submissions. Resolution of at least 300 dpi for all figures is required. Only TIFF, EPS, PowerPoint, and high-resolution PDF for Mac or PC are allowed for figures that will appear in the main text. Authors may submit PRC or U3D files for 3D images; these must be accompanied by 2D representations in TIFF, EPS, or high-resolution PDF format. (See *SI* below for supplementary material.) Color images must be in RGB (red, green, blue) mode. Include the font files for any text. Images must be final size, preferably one column width (8.7 cm). Figures wider than one column should be sized to 11.4 cm or 17.8 cm wide. Numbers, letters, and symbols should be no smaller than 6 points (2 mm) and no larger than 12 points (6 mm) after reduction and must be consistent. Composite figures must be preassembled. Figures must be submitted as separate files, not embedded in manuscript text. See the [Digital Art Guidelines](#). Figures and tables may be enlarged to improve legibility of text.

Tables. Each table should have a brief title above the table. Table footnotes should be below the table. Tables must be submitted as separate files, not embedded in the manuscript text. Publication-ready formats include Word and LaTeX.

SI. The main text of the paper must stand on its own without the *SI*. Refer to *SI* in the manuscript at an appropriate point in the text. Number supporting figures and tables starting with S1, S2, etc. Authors are limited to no more than 10 *SI* files, not including movie files.

Authors who place detailed materials and methods in *SI* must provide sufficient detail in the main text methods to enable a reader to follow the logic of the procedures and results and also must reference the online methods. If a paper is fundamentally a study of a new method or technique, then the methods must be described completely in the main text.

Because PNAS edits *SI* and composes it into a single PDF, authors must provide the following file formats only.

- **Text:** Supply Word, RTF, or LaTeX files (LaTeX files must be accompanied by a PDF with the same file name for visual reference).
- **Figures:** Provide a brief legend for each supporting figure after the supporting text. Provide figure images in TIFF, EPS, PowerPoint, high-resolution PDF, JPEG, or GIF format; figures may not be embedded in manuscript text. When saving TIFF files, use only LZW compression; do not use JPEG compression. Do not save figure numbers, legends, or author names as part of the image. Composite figures must be preassembled.
- **3D figures:** Supply a composable U3D or PRC file so that it may be edited and composed. Authors may submit a PDF file but please note it will be published in raw format and will not be edited or composed.
- **Tables:** Supply Word, RTF, or LaTeX files (LaTeX files must be accompanied by a PDF with the same file name for visual reference); include only one table per file. Do not use tabs or spaces to separate columns in Word tables.
- **Datasets:** Supply Excel (.xls), RTF, PDF, CSV, or TXT files. This file type will be published in raw format and will not be edited or composed.
- **Movies:** Supply Audio Video Interleave (avi), Quicktime (mov), Windows Media (wmv), animated GIF (gif), or MPEG files and submit a brief legend for each movie in a Word or RTF file. All movies should be submitted at the desired reproduction size and length. Movies should be no

more than 10 MB in size.

- **Still images:** Authors must provide a still image from each video file. Supply TIFF, EPS, high-resolution PDF, JPEG, or GIF files.
- **Appendices:** PNAS prefers that authors submit individual source files to ensure readability. If this is not possible, supply a single PDF file that contains all of the *SI* associated with the paper. This file type will be published in raw format and will not be edited or composed.

Journal Cover Figures. Authors are invited to submit scientifically interesting and visually arresting cover images. For examples, see www.pnas.org/coverarchive. Illustrations need not be reprinted in the article but should be representative of the work. Images should be original, and authors grant PNAS the exclusive license to publish. Include a brief lay-language caption (50–60 words) and credit information (e.g., Image courtesy of...). Images should be 21 cm wide by 22.5 cm high. Files should be EPS or TIFF and should be in RGB (red, green, blue) color mode. Cover figure files may be submitted online when the paper is submitted or may be sent to PNAScovers@nas.edu; contact PNAS for instructions on submitting large files. Submissions provided outside of the online submission system should include manuscript number, author name, phone, and email.

Manuscript Format

Manuscript Order. Many authors find it useful to organize their manuscripts with the following order of sections: title page, abstract, significance statement, introduction, results, discussion, materials and methods, acknowledgments, references, and figure legends. Provided that authors present information clearly and concisely, other variations to this format are allowed. Number all manuscript pages starting with the title page as page 1.

Title Page. Please note that information entered in the submission form will be used for publication purposes (e.g., author contact information and affiliations). Please also include the following information on the title page:

Classification: Select a major (Physical, Social, or Biological Sciences) and a minor category from the following. Dual classifications are permitted between major categories and in exceptional cases, subject to Editorial Board approval, within a major category.

PHYSICAL SCIENCES: Applied Mathematics; Applied Physical Sciences; Astronomy; Chemistry; Computer Sciences; Earth, Atmospheric, and Planetary Sciences; Engineering; Environmental Sciences; Mathematics; Physics; Statistics; and Sustainability Science.

SOCIAL SCIENCES: Anthropology; Economic Sciences; Environmental Sciences; Political Sciences; Psychological and Cognitive Sciences; Social Sciences; and Sustainability Science.

BIOLOGICAL SCIENCES: Agricultural Sciences; Anthropology; Applied Biological Sciences; Biochemistry; Biophysics and Computational Biology; Cell Biology; Developmental Biology; Ecology; Environmental Sciences; Evolution; Genetics; Immunology and Inflammation; Medical Sciences; Microbiology; Neuroscience; Pharmacology; Physiology; Plant Biology; Population Biology; Psychological and Cognitive Sciences; Sustainability Science; and Systems Biology.

Title: Titles should be no more than three typeset lines (generally 135 characters including spaces) and should be comprehensible to a broad scientific audience. The specific organism studied should be included. Please provide a short title of fewer than 50 characters including spaces for mobile devices and RSS feeds.

Author Affiliation: Include department, institution, and com-

plete address, with the ZIP/postal code, for each author. Use superscript lower case letters to match authors with institutions. Authors are encouraged to supply their [ORCID iD](#) at submission.

Corresponding Author: The name, complete address, telephone number, and email address of the author to whom correspondence and proofs should be sent. Email addresses will appear in the article footnotes.

Keywords: Keywords are listed below the abstract of the published article. At least three keywords are required at submission.

Abstract. Provide an abstract of no more than 250 words on page 2 of the manuscript. Abstracts should explain to the general reader the major contributions of the article. References in the abstract must be cited in full within the abstract itself and cited in the text.

Significance Statement. Authors must submit a 120-word-maximum statement about the significance of their research paper written at a level understandable to an undergraduate-educated scientist outside their field of specialty. The primary goal of the Significance Statement is to explain the relevance of the work in broad context to a broad readership. The Significance Statement appears in the paper itself and is required for all research papers.

Text. Describe procedures in sufficient detail so that the work can be repeated. Methods must be presented after results and discussion. Follow the spelling and usage given in *Webster's Third New International Dictionary* or the *Random House Dictionary of the English Language*. Avoid laboratory jargon. Correct chemical names should be given, and strains of organisms should be specified. Trade names should be identified by an initial capital letter with the remainder of the name lowercase. Names of suppliers of uncommon reagents or instruments should be provided. Use *Système International* units and symbols whenever possible. Statements of novelty and priority are not permitted in the text.

Language-Editing Services: Prior to submission, authors who believe their manuscripts would benefit from professional editing are encouraged to use a language-editing service (see list at www.pnas.org/site/authors/language-editing.xhtml). PNAS does not take responsibility for or endorse these services, and their use has no bearing on acceptance of a manuscript for publication.

Use of URLs in Text: As a publisher, PNAS must be able to archive the data essential to a published article. Where such archiving is not possible, deposition of data in public databases, such as GenBank, ArrayExpress, Protein Data Bank, Unidata, and others outlined in the Information for Authors, is acceptable.

Only links to websites that are permanent public repositories, such as self-perpetuating online resources funded by government, academia, and industry, are permitted. Links to an author's personal web page are not acceptable. PNAS allows authors to post their PNAS paper on their home page after the paper is published in PNAS.

Gene Nomenclature: Prior to submission, authors should consult [Genecards](#), or [MGI Nomenclature page](#), or [HUGO Gene Nomenclature Committee](#), or equivalent resources, to ensure standardized nomenclature is used for species-specific gene and protein names. For proposed gene names that are not already approved, please submit the gene symbols to the appropriate nomenclature committee as these must be deposited and approved before publication of the article.

Abbreviations: Abbreviations should be accessible to a broad scientific audience; abbreviations that are specific to a particular field should be defined at first mention in the text.

Nomenclature and Style: Use international standards on nomenclature. PNAS uses Scientific Style and Format: The CSE Manual for Authors, Editors, and Publishers (8th edition, 2014) as the primary style guide.

Footnotes. PNAS distinguishes author affiliations and footnotes from in-text footnotes by assigning a different set of footnote symbols to each type. Superscript lowercase letters separated by commas (no spaces) are used for author affiliations. Superscript numerals separated by commas (no spaces) are used for author footnotes. In-text footnotes should be preceded by a footnote symbol, used in the order *, †, ‡, §, ¶, #, ||, **, ††, ‡‡, §§, ¶¶, ##.

Acknowledgments. List acknowledgments and funding sources. PNAS collaborates with [FundRef](#) to use a standard taxonomy of funder names. Dedications are rarely allowed.

References. References must be in PNAS style. Only published or in-press papers and books may be cited in the reference list. For references to in-press articles, please confirm with the cited journal that the article is in press and include a DOI number and online publication date. Unpublished abstracts of papers presented at meetings or references to “data not shown” are not permitted. References should be cited in numerical order as they appear in text, and all references, including for the SI, should be included in the main manuscript file. Because tables and figures will be inserted in the text where first cited, references in these sections should be numbered accordingly. **Include the full title for each cited article.** All authors may be named in the citation for initial submissions. For revisions or final submissions, if there are more than five authors, list the first author's name followed by et al. Provide volume and issue numbers for journal articles as applicable; provide DOI numbers if volume/issue numbers are not available. Provide inclusive page ranges for journal articles and book chapters. Provide date of access for online sources.

Journal articles are cited as follows:

10. Neuhaus J-M, Sticher L, Meins F, Jr, Boller T (1991) A short C-terminal sequence is necessary and sufficient for the targeting of chitinases to the plant vacuole. *Proc Natl Acad Sci USA* 88(22):10362–10366.

Cite research datasets in the references if they have a DOI, and list the authors, title, publisher (repository name), and identifier (DOI in URL format) as follows:

12. van Sebille E, Doblin M (2016) Data from “Drift in ocean currents impacts intergenerational microbial exposure to temperature.” Figshare. <https://dx.doi.org/10.6084/m9.figshare.3178534.v2>.

Use MEDLINE/PubMed abbreviations of journal titles or use the full journal title for any journals not indexed in MEDLINE.

Articles or chapters in books are cited as follows:

14. Hill AVS (1991) HLA associations with malaria in Africa: some implications for MHC evolution. *Molecular Evolution of the Major Histocompatibility Complex*, eds Klein J, Klein D (Springer, Heidelberg), pp 403–420.

Figure Legends. Provide these separately from figures, after the references in the manuscript. For figures with multiple panels, the first sentence of the legend should be a brief overview of the entire figure; each panel must be explicitly referenced and described at least once in the figure legend. Graphs should include clearly labeled error bars described in the figure legend. Authors must state whether a number that follows the \pm sign is a standard error (SEM) or a standard deviation (SD). The number of independent data points (N) represented in a graph must be indicated in the legend. Numerical axes on graphs should go to 0, except for log axes.

Updates

See www.pnas.org/site/authors/index.xhtml for the latest version of the Information for Authors.