Medicine in Novel Technology and Devices is a peer-reviewed open access journal. The journal publishes cutting-edge approaches, techniques and instruments which serve within a medical environment. It focuses on the application of those technologies and devices within human health, including disease prevention, diagnosis, treatment, prognosis, monitoring as well within nursing and rehabilitation.

Article types accepted include, but are not limited to, original research articles, reviews, case reports, short communications and editorials.

Medicine in Novel Technology and Devices is an Official Journal of Beijing Advanced Innovation Center for Biomedical Engineering, Beihang University.

Benefits to authors

We provide many author benefits, such as APC waivers for accepted manuscripts submitted by 31 December 2020, certificate of publication for your article and much more. Please click here for more information on our author services.

Please see our Guide for Authors for information on article submission. If you require any further information or help, please visit our Support Center.

ABSTRACTING AND INDEXING

Directory of Open Access Journals (DOAJ)

EDITORIAL BOARD

Co Editors-in-Chief
Yubo Fan, Beihang University School of Economics and Management, Beijing, China
Biomechanics and Mechanobiology, Rehabilitation, Medical Device.
Scott Hollister, Department of Biomedical Engineering, Georgia Institute of Technology, Atlanta, United States

Executive Editor-in-Chief
Cheng-Kung Cheng, Shanghai Jiao Tong University, Shanghai, China
Orthopaedic Biomechanics, Orthopaedic Implant, Biodegradable materials, assistive technology

**Associate Editors**

**Xiao-Yan Deng**, Beihang University, Beijing, China  
Hemodynamics, Cardiovascular implants, Tissue engineering, artificial blood vessel, artificial heart valve.

**Peter Lee**, The University of Melbourne, Melbourne, Australia

**Peter X. Ma**, University of Michigan Department of Materials Science and Engineering, Ann Arbor, United States  
Bone biology, Biomechanics, Medical imaging, Ultrasound diagnosis, Ultrasound treatment, Bone fracture healing, Osteoporosis, Biosensor, Computational biomechanics

**Ming Zhang**, The Hong Kong Polytechnic University Department of Health Technology and Informatics, Kowloon, Hong Kong

**Section Editors**

**Artificial Intelligence and Medical Robot**

**Jiangzhen Guo**, Beihang University, Beijing, China  
Biomechanics, smart rehabilitation, artificial intelligence, medical robot, rehabilitation robot

**Bacteria and Viruses**

**Jing Zhang**, Beihang University, Beijing, China  
Bioinformatics, vaccine development, tumorigenesis

**Biodegradable Materials**

**Dechang Li**, Zhejiang University, Hangzhou, China  
Cellular and molecular mechanics, structure and function relationships of biomolecules, molecular interactions, molecular modelling, mechanics of biomaterials.

**Yuan Lin**, The University of Hong Kong, Pokfulam Road, Hong Kong  
Cell Mechanics, Cell-matrix Interaction, Mechanobiology, Mechanics of Biological Materials

**Chao Qi**, Chongqing University College of Bioengineering, Chongqing, China  
Biomimetic synthesis, Nanostructured biomaterials, Nanotheranostics, Drug delivery, Bioimaging, Tissue engineering

**Biomedical Informatics and Intelligent Diagnosis**

**Xinge Yu**, City University of Hong Kong, Kowloon, Hong Kong  
Biomedical Engineering, Bio-electronics, Flexible electronics, Wearable healthcare, Materials Science and Engineering

**Cardiovascular Intervention**

**tinghui zheng**, Sichuan University, Chengdu, Sichuan, China  
Computational fluid dynamics, hemodynamics, cardiovascular system, biomechanics

**Duanduan Chen**, Beijing Institute of Technology, Beijing, China  
Biomechanics, hemodynamics, image processing, endovascular repair, aortic dissection, aneurysm, stenosis, stent

**Zengsheng Chen**, Beihang University Advanced Innovation Center for Biomedical Engineering, Shanghai, China  
Blood contacting medical device (Artificial lung/kidney, blood pump, ECMO), Mechanical Circulatory Support, Biomechanics, Hemodynamic, Blood Trauma, Thrombosis and hemostasis, Platelet function, Biomaterial, CFD simulation, Mechanical Circulatory Support

**Ying He**, Dalian University of Technology School of Energy and Power Engineering, Dalian, China  
Hemodynamics, Finite element method, Bioheat and mass transfer, In-vitro vascular modelling

**Yunlong Huo**, Shanghai Jiao Tong University, Shanghai, China  
Biomechanics, innovative diagnostic methods and medical devices thermal/fluids, CFD, and multiphysics

**Zhiyong Li**, Southeast University, Dhaka, Bangladesh  
Biomechanics, mechanobiology, cardiovascular disease, atherosclerosis, mathematical modelling, numerical method, computational simulation, image analysis

**Fuyou Liang**, Shanghai Jiao Tong University, Shanghai, China  
Cardiovascular biomechanics, Hemodynamics, Computational modeling, non-invasive medical device

**Aike Qiao**, Beijing University of Technology, Beijing, China  
Biomedical engineering, biomechanics, stent intervention, hemodynamics, numerical simulation

**Shengzhang Wang**, Fudan University, Shanghai, China  
Hemodynamics, Finite element modeling and simulaiton, Cardiovascular Implantable and Interventional Device, Flow Diverter, Heart Valve, Stent

**Chi Zhang**, Beihang University, Beijing, China
Hemodynamics, Biosignal Processing

**Clinical Medicine**
Xin Zhao, The Hong Kong Polytechnic University, Hung Hom, Hong Kong
Biomaterials, Tissue Engineering, Drug Delivery, Cell Micro-environment, Biofabrication

**Medical Imaging Technology**
Puxiang Lai, The Hong Kong Polytechnic University, Hung Hom, Hong Kong
Biomedical optical imaging, Biomedical ultrasound imaging, Medical imaging, Photoacoustic imaging, Optoacoustic imaging, Acousto-optic imaging, Ultrasound-modulated optical tomography, Computational optical imaging, Wavefront shaping, Optical phase conjugation, Adaptive optics, Applications of AI techniques in medical imaging
Shuhua Yue, Beihang University, Beijing, China
Label-free spectroscopic imaging, coherent Raman scattering microscopy, nonlinear optical microscopy, cell metabolism, cancer metabolism, cancer diagnosis

**Orthopedics and Rehabilitation Engineering**
Chih-Hsiu Cheng, Chang Gung University, Taoyuan, Taiwan
motion analysis, biomechanics, Assistive technology, rehabilitation
Daniel Fong, Loughborough University, Loughborough, United Kingdom
sports medicine, musculoskeletal, biomechanics, rehabilitation, motion sensing and monitoring, orthopaedics
Ming Ni, Shanghai University of Medicine & Health Sciences, Pudong New Area Peoples’ Hospital, Department of Orthopaedics, Shanghai, China
Biomechanics, Finite Element Analysis, Digital Medicine, Bone Fracture and Repair, and Joint Surgery
Yan (Annie) Wang, The Hong Kong Polytechnic University, Hung Hom, Hong Kong
Biomechanics of musculoskeletal system, Rehabilitation engineering, Sports injury, Motion analysis, Computational modelling and simulation, Prosthetics and orthotics bioengineering, Foot biomechanics and foot-support design, Bone and joint motion and mechanics, Ankle joint surgery, Ankle implant, etc.
Xiaogang Wu, Taiyuan University of Technology, Taiyuan, China
Musculoskeletal biomechanics, rehabilitation and orthopedic appliance design
Haisheng Yang, Beijing University of Technology, Beijing, China
Orthopaedic biomechanics, mechanobiology, bone adaptation, bone repair, fracture healing, computational modeling, finite element analysis, osteoporosis, medical imaging, osteocytes

**Others**
Jie Fan, University of Michigan Dearborn, Dearborn, Michigan, United States
Cell biology, Cardiovascular physiology, bioengineering, biomechanics
Junjie Wang, Wenzhou Medical University Eye Hospital, Wenzhou, China
Ocular Biomechanics, Finite Element Simulation, Refractive Surgery, Intraocular Pressure, Medical Device Development, Multiphysics, Corneal Topography, Inverse Analysis, Optimisation
Jia Yu, Soochow University, Suzhou, China
Biomechanics, Medical device by 3D printing, Rehabilitation Engineering

**Regenerative Medicine**
Jian Yu, Beihang University, Beijing, China
Molecular biology, Cell biology, Antibody engineering, Immunology, Immunotherapy, CAR-T cell immunotherapy, Tumor organoid, Drug repositioning

**Special Aerospace Environment Life Support**
xinguang cui, Huazhong University of Science and Technology, Wuhan, China
CFD, L38Aerospace Science and Technology, Respiratory dynamics, Targeted drug delivery, Biological and environmental fluids, Inhaler, Virtual Operation, OSA, COPD, Aerosol, Air pollution
Fuhao MO, Hunan University, Changsha, China
Biomechanics, Finite element analysis, Musculoskeletal model, human body modeling, injury analysis, rehabilitation engineering.
Wenxin Niu, Tongji University, Shanghai, China
biomechanics, Rehabilitation Engineering

**Editorial Board Members**
Abdul I. Barakat, University of Applied Sciences Palaiseau, Palaiseau
Arterial fluid mechanics; Mass transport; Cellular mechanobiology; Endovascular devices; Cardiovascular bioengineering; Neurovascular pathology
David Feng, The University of Sydney Business School, Sydney
Cheng Dong, Pennsylvania State University, State College,
Cell adhesion, Cell migration, Cell signaling, Cellular biomechanics, Cancer immunology, Immunotherapy, Cell therapies
Ahmed Elsheikh, University of Liverpool, Liverpool
Ocular biomechanics, Tonometry, Intraocular pressure, Cornea, Sclera, Topography, Numerical modelling
Bingmei Fu, The City College of New York, New York
Bernd Grimm, Human Motion Institute, Munich
Wearable sensors (accelerometry, Inertial sensors, sensor fusion), physical activity monitoring, Digital outcomes, Biomarkers and Clinical trial endpoints, Ambulant patient assessment methods, Signal algorithm development and validation including machine learning, Guided routines, patient coaching and feedback systems, Exergaming.
Yih-Kuen Jan, University of Illinois at Urbana-Champaign Department of Kinesiology and Community Health, Champaign
Assistive technology, Microvascular dynamics, Soft tissue biomechanics, Rehabilitation engineering
Baohua Ji, Zhejiang University, Hangzhou
Cell-matrix interaction, Collective cell migration, and Mechanomedicine
Guoan Li, Harvard Medical School, Boston
total joint replacement, orthopaedic imaging, spine deformity correction
Xiaoli Li, Beijing Normal University, Beijing
Intelligent monitoring system, Neural signal processing (Neurocomputing), Neural engineering (Design of EEG device, FNIRS device, neurofeedback, tDCS, TMS, focus ultrasound stimulation), Engineering for brain disorder, epilepsy, autism, ADHD, AD and disorder of consciousness
Zong-Ming Li, Cleveland Clinic Lerner College of Medicine of Case Western Reserve University, Cleveland
Ching-Long Lin, The University of Iowa, Iowa City
Machine learning, deep learning, pulmonary flow, human lungs, computed tomography, computational fluid dynamics, population health, inhalation drug delivery
Haijun Niu, Beihang University, Beijing
Biomedical ultrasound, medical signal processing and speech rehabilitation.
Jeff Tza-Huei Wang, Johns Hopkins University, Baltimore
Microfluidics, Nanotechnology, Biosensors, Point-of-care diagnostics, Infectious diagnostics, cancer diagnostics
Xiaodu Wang, University of Texas at San Antonio, San Antonio
Computational haemodynamics, Thrombosis and thrombolysis, Drug delivery, Multi-scale modelling, Aortic dissection, stent-graft
Yifei Yao, Shanghai Jiao Tong University School of Biomedical Engineering, Shanghai
Ze Zhang, Université Laval, Department of Surgery, Québec
Managing Editors
Ruya Li, BeiHang University School of Biological Science and Medical Engineering, Beijing, China
Lizhen Wang, BeiHang University School of Biological Science and Medical Engineering, Beijing, China
Editorial Assistant
Yanxian Yue, BeiHang University Advanced Innovation Center for Biomedical Engineering, Beijing, China
Honorary Editors-in-Chief
Ke-Rong Dai, Shanghai 9th Peoples Hospital Affiliated to Shanghai Jiaotong University School of Medicine, Shanghai, China
Daiming Fan, Xijing Hospital, Xian, China
Jian-Cheng Fang, BeiHang University School of Instrumentation Science and Opto-electronics Engineering, Beijing, China
Savio L-Y Woo, University of Pittsburgh Musculoskeletal Research Center, Pittsburgh, United States
GUIDE FOR AUTHORS

Submission checklist
You can use this list to carry out a final check of your submission before you send it to the journal for review. Please check the relevant section in this Guide for Authors for more details.

Ensure that the following items are present:

One author has been designated as the corresponding author with contact details:
• E-mail address
• Full postal address

All necessary files have been uploaded:
Manuscript:
• Include keywords
• All figures (include relevant captions)
• All tables (including titles, description, footnotes)
• Ensure all figure and table citations in the text match the files provided
• Indicate clearly if color should be used for any figures in print
Graphical Abstracts / Highlights files (where applicable)
Supplemental files (where applicable)

Further considerations
• Manuscript has been 'spell checked' and 'grammar checked'
• All references mentioned in the Reference List are cited in the text, and vice versa
• Permission has been obtained for use of copyrighted material from other sources (including the Internet)
• A competing interests statement is provided, even if the authors have no competing interests to declare
• Journal policies detailed in this guide have been reviewed
• Referee suggestions and contact details provided, based on journal requirements

For further information, visit our Support Center.

BEFORE YOU BEGIN

Ethics in publishing
Please see our information pages on Ethics in publishing and Ethical guidelines for journal publication.

Studies in humans and animals
If the work involves the use of human subjects, the author should ensure that the work described has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans. The manuscript should be in line with the Recommendations for the Conduct, Reporting, Editing and Publication of Scholarly Work in Medical Journals and aim for the inclusion of representative human populations (sex, age and ethnicity) as per those recommendations. The terms sex and gender should be used correctly.

Authors should include a statement in the manuscript that informed consent was obtained for experimentation with human subjects. The privacy rights of human subjects must always be observed.

All animal experiments should comply with the ARRIVE guidelines and should be carried out in accordance with the U.K. Animals (Scientific Procedures) Act, 1986 and associated guidelines, EU Directive 2010/63/EU for animal experiments, or the National Institutes of Health guide for the care and use of Laboratory animals (NIH Publications No. 8023, revised 1978) and the authors should clearly indicate in the manuscript that such guidelines have been followed. The sex of animals must be indicated, and where appropriate, the influence (or association) of sex on the results of the study.

Conflict of interest
At the end of the manuscript text, under a subheading "Conflict of Interest statement", all authors must disclose any financial and personal relationships with other people or organizations that could inappropriately influence (bias) their work. Examples of potential competing interests include employment, consultancies, stock ownership, honoraria, paid expert testimony, patent applications/
registrations, and grants or other funding. Authors must disclose any interests in two places: 1. A summary declaration of interest statement in the manuscript file. If there are no interests to declare then please state this: 'The authors declare that there are no conflicts of interest.' This summary statement will be ultimately published if the article is accepted. 2. Detailed disclosures as part of a separate Conflict of Interest and Author Statements Form, which forms part of the journal's official records. The corresponding author is responsible for completing the form, and signing it on behalf of all authors. It is important for potential interests to be declared in both places and that the information matches. More information.

Submission declaration and verification
Submission of an article implies that the work described has not been published previously (except in the form of an abstract, a published lecture or academic thesis, see 'Multiple, redundant or concurrent publication' for more information), that it is not under consideration for publication elsewhere, that its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere in the same form, in English or in any other language, including electronically without the written consent of the copyright-holder. To verify originality, your article may be checked by the originality detection service Crossref Similarity Check.

Preprints
Please note that preprints can be shared anywhere at any time, in line with Elsevier's sharing policy. Sharing your preprints e.g. on a preprint server will not count as prior publication (see 'Multiple, redundant or concurrent publication' for more information).

Author Contributions
Each author is required to declare his or her individual contribution to the article: all authors must have materially participated in the research and/or article preparation, so roles for all authors should be described using the relevant CRediT roles: Conceptualization; Data curation; Formal analysis; Funding acquisition; Investigation; Methodology; Project administration; Resources; Software; Supervision; Validation; Visualization; Roles/Writing - original draft; Writing - review & editing. The statement that all authors have approved the final article should be true and included in the disclosure. More details and an example. Conflict of Interest and Author Statements Form should be provided in a separate file during the submission process and will appear above the Acknowledgement section of the published paper as shown below.

CRediT author statement

Author contributions
For transparency, we encourage authors to submit an author statement file outlining their individual contributions to the paper using the relevant CRediT roles: Conceptualization; Data curation; Formal analysis; Funding acquisition; Investigation; Methodology; Project administration; Resources; Software; Supervision; Validation; Visualization; Roles/Writing - original draft; Writing - review & editing. Authorship statements should be formatted with the names of authors first and CRediT role(s) following. More details and an example

Authorship
All authors should have made substantial contributions to all of the following: (1) the conception and design of the study, or acquisition of data, or analysis and interpretation of data, (2) drafting the article or revising it critically for important intellectual content, (3) final approval of the version to be submitted.

Clinical trial results
In line with the position of the International Committee of Medical Journal Editors, the journal will not consider results posted in the same clinical trials registry in which primary registration resides to be prior publication if the results posted are presented in the form of a brief structured (less than 500 words) abstract or table. However, divulging results in other circumstances (e.g., investors' meetings) is discouraged and may jeopardise consideration of the manuscript. Authors should fully disclose all posting in registries of results of the same or closely related work.
Reporting clinical trials
Randomized controlled trials should be presented according to the CONSORT guidelines. At manuscript submission, authors must provide the CONSORT checklist accompanied by a flow diagram that illustrates the progress of patients through the trial, including recruitment, enrollment, randomization, withdrawal and completion, and a detailed description of the randomization procedure. The CONSORT checklist and template flow diagram are available online.

Registration of clinical trials
Registration in a public trials registry is a condition for publication of clinical trials in this journal in accordance with International Committee of Medical Journal Editors recommendations. Trials must register at or before the onset of patient enrolment. The clinical trial registration number should be included at the end of the abstract of the article. A clinical trial is defined as any research study that prospectively assigns human participants or groups of humans to one or more health-related interventions to evaluate the effects of health outcomes. Health-related interventions include any intervention used to modify a biomedical or health-related outcome (for example drugs, surgical procedures, devices, behavioural treatments, dietary interventions, and process-of-care changes). Health outcomes include any biomedical or health-related measures obtained in patients or participants, including pharmacokinetic measures and adverse events. Purely observational studies (those in which the assignment of the medical intervention is not at the discretion of the investigator) will not require registration.

Copyright
Upon acceptance of an article, authors will be asked to complete an 'Exclusive License Agreement' (see more information on this). Permitted third party reuse of open access articles is determined by the author's choice of user license.

Author rights
As an author you (or your employer or institution) have certain rights to reuse your work. More information.

Elsevier supports responsible sharing
Find out how you can share your research published in Elsevier journals.

Role of the funding source
You are requested to identify who provided financial support for the conduct of the research and/or preparation of the article and to briefly describe the role of the sponsor(s), if any, in study design; in the collection, analysis and interpretation of data; in the writing of the report; and in the decision to submit the article for publication. If the funding source(s) had no such involvement then this should be stated.

Open access
Please visit our Open Access page for more information.

Elsevier Researcher Academy
Researcher Academy is a free e-learning platform designed to support early and mid-career researchers throughout their research journey. The "Learn" environment at Researcher Academy offers several interactive modules, webinars, downloadable guides and resources to guide you through the process of writing for research and going through peer review. Feel free to use these free resources to improve your submission and navigate the publication process with ease.

Language (usage and editing services)
Please write your text in good English (American or British usage is accepted, but not a mixture of these). Authors who feel their English language manuscript may require editing to eliminate possible grammatical or spelling errors and to conform to correct scientific English may wish to use the English Language Editing service available from Elsevier's Author Services.

Informed consent and patient details
Studies on patients or volunteers require ethics committee approval and informed consent, which should be documented in the paper. Appropriate consents, permissions and releases must be obtained where an author wishes to include case details or other personal information or images of patients and any other individuals in an Elsevier publication. Written consents must be retained by the author but copies should not be provided to the journal. Only if specifically requested by the journal in exceptional circumstances (for example if a legal issue arises) the author must provide copies of the consents or evidence that such consents have been obtained. For more information, please review the
Elsevier Policy on the Use of Images or Personal Information of Patients or other Individuals. Unless you have written permission from the patient (or, where applicable, the next of kin), the personal details of any patient included in any part of the article and in any supplementary materials (including all illustrations and videos) must be removed before submission.

Submission
Our online submission system guides you stepwise through the process of entering your article details and uploading your files. The system converts your article files to a single PDF file used in the peer-review process. Editable files (e.g., Word, LaTeX) are required to typeset your article for final publication. All correspondence, including notification of the Editor's decision and requests for revision, is sent by e-mail.

PREPARATION

Peer review
This journal operates a single blind review process. All contributions are typically sent to a minimum of two independent expert reviewers to assess the scientific quality of the paper. The Editor is responsible for the final decision regarding acceptance or rejection of articles. The Editor's decision is final. More information on types of peer review.

Editors are not involved in decisions about papers which they written themselves or have been written by family members or colleagues or which relate to products or services in which the editor has an interest. Any such submission is subject to all of the journal?s usual procedures, with peer review handled independently of the relevant editor and their research groups.

Use of word processing software
It is important that the file be saved in the native format of the word processor used. The text should be in single-column format. Keep the layout of the text as simple as possible. Most formatting codes will be removed and replaced on processing the article. In particular, do not use the word processor's options to justify text or to hyphenate words. However, do use bold face, italics, subscripts, superscripts etc. When preparing tables, if you are using a table grid, use only one grid for each individual table and not a grid for each row. If no grid is used, use tabs, not spaces, to align columns. The electronic text should be prepared in a way very similar to that of conventional manuscripts (see also the Guide to Publishing with Elsevier). Note that source files of figures, tables and text graphics will be required whether or not you embed your figures in the text. See also the section on Electronic artwork.

To avoid unnecessary errors you are strongly advised to use the 'spell-check' and 'grammar-check' functions of your word processor.

Article structure
Subdivision - numbered sections
Divide your article into clearly defined and numbered sections. Subsections should be numbered 1.1 (then 1.1.1, 1.1.2, ...), 1.2, etc. (the abstract is not included in section numbering). Use this numbering also for internal cross-referencing: do not just refer to 'the text'. Any subsection may be given a brief heading. Each heading should appear on its own separate line.

Introduction
State the objectives of the work and provide an adequate background, avoiding a detailed literature survey or a summary of the results.

Material and methods
Provide sufficient details to allow the work to be reproduced by an independent researcher. Methods that are already published should be summarized, and indicated by a reference. If quoting directly from a previously published method, use quotation marks and also cite the source. Any modifications to existing methods should also be described.

Theory/calculation
A Theory section should extend, not repeat, the background to the article already dealt with in the Introduction and lay the foundation for further work. In contrast, a Calculation section represents a practical development from a theoretical basis.

Results
Results should be clear and concise.
Discussion
This should explore the significance of the results of the work, not repeat them. A combined Results and Discussion section is often appropriate. Avoid extensive citations and discussion of published literature.

Conclusions
The main conclusions of the study may be presented in a short Conclusions section, which may stand alone or form a subsection of a Discussion or Results and Discussion section.

Appendices
If there is more than one appendix, they should be identified as A, B, etc. Formulae and equations in appendices should be given separate numbering: Eq. (A.1), Eq. (A.2), etc.; in a subsequent appendix, Eq. (B.1) and so on. Similarly for tables and figures: Table A.1; Fig. A.1, etc.

Essential title page information
• Title. Concise and informative. Titles are often used in information-retrieval systems. Avoid abbreviations and formulae where possible.
• Author names and affiliations. Please clearly indicate the given name(s) and family name(s) of each author and check that all names are accurately spelled. You can add your name between parentheses in your own script behind the English transliteration. Present the authors' affiliation addresses (where the actual work was done) below the names. Indicate all affiliations with a lowercase superscript letter immediately after the author's name and in front of the appropriate address. Provide the full postal address of each affiliation, including the country name and, if available, the e-mail address of each author.
• Corresponding author. Clearly indicate who will handle correspondence at all stages of refereeing and publication, also post-publication. This responsibility includes answering any future queries about Methodology and Materials. Ensure that the e-mail address is given and that contact details are kept up to date by the corresponding author.
• Present/permanent address. If an author has moved since the work described in the article was done, or was visiting at the time, a 'Present address' (or 'Permanent address') may be indicated as a footnote to that author's name. The address at which the author actually did the work must be retained as the main, affiliation address. Superscript Arabic numerals are used for such footnotes.

Highlights
Highlights are mandatory for this journal as they help increase the discoverability of your article via search engines. They consist of a short collection of bullet points that capture the novel results of your research as well as new methods that were used during the study (if any). Please have a look at the examples here: example Highlights.

Highlights should be submitted in a separate editable file in the online submission system. Please use 'Highlights' in the file name and include 3 to 5 bullet points (maximum 85 characters, including spaces, per bullet point).

Abstract
A concise and factual abstract is required. The abstract should state briefly the purpose of the research, the principal results and major conclusions. An abstract is often presented separately from the article, so it must be able to stand alone. For this reason, References should be avoided, but if essential, then cite the author(s) and year(s). Also, non-standard or uncommon abbreviations should be avoided, but if essential they must be defined at their first mention in the abstract itself. An abstract should be no more than 250 words.

Keywords
Immediately after the abstract, provide a maximum of 6 keywords, using American spelling and avoiding general and plural terms and multiple concepts (avoid, for example, 'and', 'of'). Be sparing with abbreviations: only abbreviations firmly established in the field may be eligible. These keywords will be used for indexing purposes.

Abbreviations
Define abbreviations that are not standard in this field in a footnote to be placed on the first page of the article. Such abbreviations that are unavoidable in the abstract must be defined at their first mention there, as well as in the footnote. Ensure consistency of abbreviations throughout the article.
Acknowledgements
Collate acknowledgements in a separate section at the end of the article before the references and do not, therefore, include them on the title page, as a footnote to the title or otherwise. List here those individuals who provided help during the research (e.g., providing language help, writing assistance or proof reading the article, etc.).
Please note that funding information must appear under the Acknowledgments heading.

Formatting of funding sources
List funding sources in this standard way to facilitate compliance to funder’s requirements:

Funding: This work was supported by the National Institutes of Health [grant numbers xxxx, yyyy]; the Bill & Melinda Gates Foundation, Seattle, WA [grant number zzzz]; and the United States Institutes of Peace [grant number aaaa].

It is not necessary to include detailed descriptions on the program or type of grants and awards. When funding is from a block grant or other resources available to a university, college, or other research institution, submit the name of the institute or organization that provided the funding.

If no funding has been provided for the research, please include the following sentence:

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Math formulae
Please submit math equations as editable text and not as images. Present simple formulae in line with normal text where possible and use the solidus (/) instead of a horizontal line for small fractional terms, e.g., X/Y. In principle, variables are to be presented in italics. Powers of e are often more conveniently denoted by exp. Number consecutively any equations that have to be displayed separately from the text (if referred to explicitly in the text).

Footnotes
Footnotes should be used sparingly. Number them consecutively throughout the article. Many word processors can build footnotes into the text, and this feature may be used. Otherwise, please indicate the position of footnotes in the text and list the footnotes themselves separately at the end of the article. Do not include footnotes in the Reference list.

Artwork
Image manipulation
Whilst it is accepted that authors sometimes need to manipulate images for clarity, manipulation for purposes of deception or fraud will be seen as scientific ethical abuse and will be dealt with accordingly. For graphical images, this journal is applying the following policy: no specific feature within an image may be enhanced, obscured, moved, removed, or introduced. Adjustments of brightness, contrast, or color balance are acceptable if and as long as they do not obscure or eliminate any information present in the original. Nonlinear adjustments (e.g. changes to gamma settings) must be disclosed in the figure legend.

Electronic artwork
General points
• Make sure you use uniform lettering and sizing of your original artwork.
• Embed the used fonts if the application provides that option.
• Aim to use the following fonts in your illustrations: Arial, Courier, Times New Roman, Symbol, or use fonts that look similar.
• Number the illustrations according to their sequence in the text.
• Use a logical naming convention for your artwork files.
• Provide captions to illustrations separately.
• Size the illustrations close to the desired dimensions of the published version.
• Submit each illustration as a separate file.
• Ensure that color images are accessible to all, including those with impaired color vision.

A detailed guide on electronic artwork is available. You are urged to visit this site; some excerpts from the detailed information are given here.

Formats
If your electronic artwork is created in a Microsoft Office application (Word, PowerPoint, Excel) then please supply 'as is' in the native document format.

Regardless of the application used other than Microsoft Office, when your electronic artwork is finalized, please 'Save as' or convert the images to one of the following formats (note the resolution requirements for line drawings, halftones, and line/halftone combinations given below):

- EPS (or PDF): Vector drawings, embed all used fonts.
- TIFF (or JPEG): Color or grayscale photographs (halftones), keep to a minimum of 300 dpi.
- TIFF (or JPEG): Bitmapped (pure black & white pixels) line drawings, keep to a minimum of 1000 dpi.
- TIFF (or JPEG): Combinations bitmapped line/half-tone (color or grayscale), keep to a minimum of 500 dpi.

**Please do not:**
- Supply files that are optimized for screen use (e.g., GIF, BMP, PICT, WPG); these typically have a low number of pixels and limited set of colors;
- Supply files that are too low in resolution;
- Submit graphics that are disproportionately large for the content.

**Color artwork**

Please make sure that artwork files are in an acceptable format (TIFF (or JPEG), EPS (or PDF) or MS Office files) and with the correct resolution. If, together with your accepted article, you submit usable color figures then Elsevier will ensure, at no additional charge, that these figures will appear in color online (e.g., ScienceDirect and other sites). [Further information on the preparation of electronic artwork.](#)

**Illustration services**

[Elsevier's Author Services](#) offers Illustration Services to authors preparing to submit a manuscript but concerned about the quality of the images accompanying their article. Elsevier's expert illustrators can produce scientific, technical and medical-style images, as well as a full range of charts, tables and graphs. Image 'polishing' is also available, where our illustrators take your image(s) and improve them to a professional standard. Please visit the website to find out more.

**Figure captions**

Ensure that each illustration has a caption. Supply captions separately, not attached to the figure. A caption should comprise a brief title (**not** on the figure itself) and a description of the illustration. Keep text in the illustrations themselves to a minimum but explain all symbols and abbreviations used.

**Tables**

Please submit tables as editable text and not as images. Tables can be placed either next to the relevant text in the article, or on separate page(s) at the end. Number tables consecutively in accordance with their appearance in the text and place any table notes below the table body. Be sparing in the use of tables and ensure that the data presented in them do not duplicate results described elsewhere in the article. Please avoid using vertical rules and shading in table cells.

**References**

**Citation in text**

Please ensure that every reference cited in the text is also present in the reference list (and vice versa). Any references cited in the abstract must be given in full. Unpublished results and personal communications are not recommended in the reference list, but may be mentioned in the text. If these references are included in the reference list they should follow the standard reference style of the journal and should include a substitution of the publication date with either 'Unpublished results' or 'Personal communication'. Citation of a reference as 'in press' implies that the item has been accepted for publication.

**Reference links**

Increased discoverability of research and high quality peer review are ensured by online links to the sources cited. In order to allow us to create links to abstracting and indexing services, such as Scopus, CrossRef and PubMed, please ensure that data provided in the references are correct. Please note that incorrect surnames, journal/book titles, publication year and pagination may prevent link creation. When copying references, please be careful as they may already contain errors. Use of the DOI is highly encouraged.
A DOI is guaranteed never to change, so you can use it as a permanent link to any electronic article. An example of a citation using DOI for an article not yet in an issue is: VanDecar J.C., Russo R.M., James D.E., Ambhe W.B., Franke M. (2003). Aseismic continuation of the Lesser Antilles slab beneath northeastern Venezuela. Journal of Geophysical Research, https://doi.org/10.1029/2001JB000884. Please note the format of such citations should be in the same style as all other references in the paper.

**Web references**
As a minimum, the full URL should be given and the date when the reference was last accessed. Any further information, if known (DOI, author names, dates, reference to a source publication, etc.), should also be given. Web references can be listed separately (e.g., after the reference list) under a different heading if desired, or can be included in the reference list.

**Data references**
This journal encourages you to cite underlying or relevant datasets in your manuscript by citing them in your text and including a data reference in your Reference List. Data references should include the following elements: author name(s), dataset title, data repository, version (where available), year, and global persistent identifier. Add [dataset] immediately before the reference so we can properly identify it as a data reference. The [dataset] identifier will not appear in your published article.

**References in a special issue**
Please ensure that the words ‘this issue’ are added to any references in the list (and any citations in the text) to other articles in the same Special Issue.

**Reference style**

**Text:** Indicate references by number(s) in square brackets in line with the text. The actual authors can be referred to, but the reference number(s) must always be given.

**List:** Number the references (numbers in square brackets) in the list in the order in which they appear in the text.

**Examples:**
Reference to a journal publication:
Reference to a journal publication with an article number:
Reference to a book:
Reference to a chapter in an edited book:
Reference to a website:
Reference to a dataset:
Note shortened form for last page number. e.g., 51–9, and that for more than 6 authors the first 6 should be listed followed by 'et al.' For further details you are referred to 'Uniform Requirements for Manuscripts submitted to Biomedical Journals' (J Am Med Assoc 1997;277:927–34) (see also Samples of Formatted References).

**Journal abbreviations source**
Journal names should be abbreviated according to the List of Title Word Abbreviations.

**Video**
Elsevier accepts video material and animation sequences to support and enhance your scientific research. Authors who have video or animation files that they wish to submit with their article are strongly encouraged to include links to these within the body of the article. This can be done in the same way as a figure or table by referring to the video or animation content and noting in the body text where it should be placed. All submitted files should be properly labeled so that they directly relate to the video file’s content. In order to ensure that your video or animation material is directly usable, please provide the file in one of our recommended file formats with a preferred maximum
size of 150 MB per file, 1 GB in total. Video and animation files supplied will be published online in the electronic version of your article in Elsevier Web products, including ScienceDirect. Please supply 'stills' with your files: you can choose any frame from the video or animation or make a separate image. These will be used instead of standard icons and will personalize the link to your video data. For more detailed instructions please visit our video instruction pages. Note: since video and animation cannot be embedded in the print version of the journal, please provide text for both the electronic and the print version for the portions of the article that refer to this content.

**Data visualization**
Include interactive data visualizations in your publication and let your readers interact and engage more closely with your research. Follow the instructions here to find out about available data visualization options and how to include them with your article.

**Supplementary material**
Supplementary material such as applications, images and sound clips, can be published with your article to enhance it. Submitted supplementary items are published exactly as they are received (Excel or PowerPoint files will appear as such online). Please submit your material together with the article and supply a concise, descriptive caption for each supplementary file. If you wish to make changes to supplementary material during any stage of the process, please make sure to provide an updated file. Do not annotate any corrections on a previous version. Please switch off the 'Track Changes' option in Microsoft Office files as these will appear in the published version.

**Research data**
This journal encourages and enables you to share data that supports your research publication where appropriate, and enables you to interlink the data with your published articles. Research data refers to the results of observations or experimentation that validate research findings. To facilitate reproducibility and data reuse, this journal also encourages you to share your software, code, models, algorithms, protocols, methods and other useful materials related to the project.

Below are a number of ways in which you can associate data with your article or make a statement about the availability of your data when submitting your manuscript. If you are sharing data in one of these ways, you are encouraged to cite the data in your manuscript and reference list. Please refer to the "References" section for more information about data citation. For more information on depositing, sharing and using research data and other relevant research materials, visit the research data page.

**Data linking**
If you have made your research data available in a data repository, you can link your article directly to the dataset. Elsevier collaborates with a number of repositories to link articles on ScienceDirect with relevant repositories, giving readers access to underlying data that gives them a better understanding of the research described.

There are different ways to link your datasets to your article. When available, you can directly link your dataset to your article by providing the relevant information in the submission system. For more information, visit the database linking page.

For supported data repositories a repository banner will automatically appear next to your published article on ScienceDirect.

In addition, you can link to relevant data or entities through identifiers within the text of your manuscript, using the following format: Database: xxxx (e.g., TAIR: AT1G01020; CCDC: 734053; PDB: 1XFN).

**Data statement**
To foster transparency, we encourage you to state the availability of your data in your submission. This may be a requirement of your funding body or institution. If your data is unavailable to access or unsuitable to post, you will have the opportunity to indicate why during the submission process, for example by stating that the research data is confidential. The statement will appear with your published article on ScienceDirect. For more information, visit the Data Statement page.

**Data deposit and linking**
Elsevier encourages and supports authors to share raw data sets underpinning their research publication where appropriate and enables interlinking of articles and data. More information on depositing, sharing and using research data.
AFTER ACCEPTANCE

**Online proof correction**
To ensure a fast publication process of the article, we kindly ask authors to provide us with their proof corrections within two days. Corresponding authors will receive an e-mail with a link to our online proofing system, allowing annotation and correction of proofs online. The environment is similar to MS Word: in addition to editing text, you can also comment on figures/tables and answer questions from the Copy Editor. Web-based proofing provides a faster and less error-prone process by allowing you to directly type your corrections, eliminating the potential introduction of errors. If preferred, you can still choose to annotate and upload your edits on the PDF version. All instructions for proofing will be given in the e-mail we send to authors, including alternative methods to the online version and PDF.
We will do everything possible to get your article published quickly and accurately. Please use this proof only for checking the typesetting, editing, completeness and correctness of the text, tables and figures. Significant changes to the article as accepted for publication will only be considered at this stage with permission from the Editor. It is important to ensure that all corrections are sent back to us in one communication. Please check carefully before replying, as inclusion of any subsequent corrections cannot be guaranteed. Proofreading is solely your responsibility.

**Offprints**
The corresponding author will be notified and receive a link to the published version of the open access article on ScienceDirect. This link is in the form of an article DOI link which can be shared via email and social networks. For an extra charge, paper offprints can be ordered via the offprint order form which is sent once the article is accepted for publication. Both corresponding and co-authors may order offprints at any time via Elsevier's Author Services.

**AUTHOR INQUIRIES**
Visit the Elsevier Support Center to find the answers you need. Here you will find everything from Frequently Asked Questions to ways to get in touch.
You can also check the status of your submitted article or find out when your accepted article will be published.