DESCRIPTION

Information Processing in Agriculture (IPA) was established in 2013 to encourage the development of science and technology related to information processing in agriculture, through the following aims:
- Promote the use of knowledge and methods from information processing technologies in agriculture;
- Report on experiences and publications of institutes, universities, and government, as well as profitable technologies for agriculture;
- Provide a platform and opportunities for exchanging knowledge, strategies, and experiences among information processing researchers worldwide;
- Promote and encourage interactions among agriculture scientists, meteorologists, biologists (pathologists/entomologists), information technology professionals, and other stakeholders to develop and implement methods, techniques, and tools related to information processing technology in agriculture;
- Create and promote expert groups for the development of agro-meteorological databases, crop and livestock modeling, and applications for the development of crop performance-based decision support systems.

Topics of interest include, but are not limited to, the following aspects:
- Smart sensors, biosensors and bioelectronics, material and molecular innovations for chemical and biological sensing, sensors, and automation and control systems for agriculture;
- Wireless sensor networks, 4G, NB-IOT, and 5G applications in agriculture;
- Remote sensing and discrete element modeling (DEM) applications in agriculture;
- Simulation, optimization, modeling, and automated control;
- Decision support systems, intelligent systems, and artificial intelligence;
- Machine vision, computer vision, image processing and automation, and imaging technologies for high-throughput phenotyping
- Advances in spectroscopy and hyperspectral properties of biological products;
- Advanced computational approaches for solving agricultural and biological engineering problems;
- Computational fluid dynamics (CFD) applications in agriculture;
- Inspection and traceability for food quality;
- Precision agriculture, intelligent instruments, robotics, and co-robotics for agriculture;
- Internet of things, cloud computing, and precision farming;
- Big data, data mining, and data analysis for agricultural applications;
- Unmanned aerial vehicles (UAVs) for sensing, imaging, and agricultural aquacultural applications.
ABSTRACTING AND INDEXING

Directory of Open Access Journals (DOAJ)
Scopus
EI Compendex
Engineering Village - GEOBASE
INSPEC

EDITORIAL BOARD

Editor-in-Chief
Daoliang Li, China Agricultural University College of Information and Electrical Engineering, Beijing, China
Aquaculture water advanced sensing and fish behavior intelligent identification technology, Aquaculture intelligent information processing technology, Aquaculture intelligent equipment and robots, Agriculture and rural information strategy

Associate Editors
K. C. Ting, University of Illinois Urbana-Champaign, Department of Agricultural and Biological Engineering, Urbana, Illinois, United States of America
Bioprocessing and production Systems, Biomass and renewable energy, Precision information agriculture, Agricultural and biological systems Management, Agricultural safety and Health, Food quality and safety, Environmental Management, Land and water resources, Spatial distribution systems, Structures and facilities of biological systems, Indoor environmental governance, Biosensors, Bioinstruments, Bioinformatics and bionanotechnology, Intelligent mechanical systems, Automation of biological systems, Advanced life support systems
Wenzhu Yang, Hebei University, Department of Computer Science and Technology, Baoding, China
Machine vision and intelligent systems
Chinsu Lin, National Chiayi University, Department of Forestry and Natural Resources, Chiayi, Taiwan
Remote sensing, Forest management, GIS
Joao Manuel R. S. Tavares, University of Porto, Department of Mechanical Engineering, Porto, Portugal
Biomechanics, Medical Imaging, Computational Vision, Gait and Posture, Biodevices, Image Processing and Analysis, NDT
Dionysis Bochtis, Aarhus University, Department of Engineering, Aarhus, Denmark
Bio-production and related provision systems
Ya Guo, Jiangnan University College of Internet of Things Engineering, Wuxi, China
System modeling and control, Big data analysis, Sensors and instruments
Hua Liu, Old Dominion University, Department of Political Science and Geography, Norfolk, United States of America
Remote sensing, GIS, Urban environmental changes, Public health
Haiyan Cen, Zhejiang University College of Biosystems Engineering and Food Science, Hangzhou, China
Agricultural information intelligent sensing technology and equipment, Crop optical imaging, High-throughput plant phenotype analysis, Near Earth remote sensing technology
Ashfaqur Rahman, Sense-T, Sandy Bay, Australia
Aquacultural Engineering
Yingyi Chen, China Agricultural University College of Information and Electrical Engineering, Beijing, China
Computer Science and Technology, Agricultural Internet of Things, Agricultural information technology
Yang Wang, China Agricultural University College of Information and Electrical Engineering, Beijing, China
Energy and environment system optimization

Subject Editors
Xiangyun Guo, Beijing Information Science & Technology University, School of Information Management, Beijing, China
Intelligent information processing, Machine learning, Data visualization
Chen Hou, China Agricultural University College of Information and Electrical Engineering, Beijing, China
Control and optimization of complex systems
Zhu Lin, China Agricultural University College of Information and Electrical Engineering, Beijing, China
Plant Protection and Animal Health
Yingying Zheng, Utah State University, Department of Biological Engineering, Logan, Utah, United States of America
Energy utilization of biomass resources, Integrated energy system modeling and energy flow optimization, Smart grid user side demand response control strategy
Editorial Board

Sultan Aksakal, Swiss Federal Institute of Technology, Institute of Geodasy and Photogrammetry, Zurich, Switzerland
Geodasy and Photogrammetry

Kaloxylos Alexandros, University of the Peloponnese, Department of Informatics and Telecommunications, Peloponnese, Greece
Specification, Network slicing for 5G Cellular networks, V2X communications, Mobility and Session Management, Radio Resource Management

Samsuzana Abd Aziz, University Putra Malaysia, Department of Biological and Agricultural Engineering, Serdang, Malaysia
Agricultural Internet of things research

Thomas Banhazi, University of Southern Queensland, Faculty of Health Engineering and Sciences, Toowoomba, Australia
Management of thermal environment in livestock buildings, Instrumentation & sensor technologies, Air quality and ventilation issues, Image analysis in Agriculture, Precision Livestock farming, Animal housing

Siti Khairunniza Bejo, University Putra Malaysia, Department of Biological and Agricultural Engineering, Serdang, Malaysia
Image Processing, Precision Agriculture

Bruno Bernardi, University of Reggio Calabria, Department of Agriculture, Reggio Calabria, Italy
Agricultural engineering

Lawal Billa, University of Nottingham Malaysia School of Environmental and Geographical Sciences, Greater Kuala Lumpur, Malaysia
The applications of geospatial sciences and technologies in Geo-science environment

Odemir Bruno, University of Sao Paulo Institute of Physics of Sao Carlos, São Carlos, São Paulo, Brazil
Image Processing, Machine Learning

Kim-Kwang Raymond Choo, University of South Australia, Information Security Institute, Adelaide, South Australia, Australia
Cyber Security, Digital Forensics, Blockchain, Data Analytics

Daniel Cozzolino, The University of Adelaide School of Agriculture Food & Wine, Adelaide, Australia
Authentication, Fraud and origin of foods, The effect of climate change in food quality (e.g. grain), Process analytics, In field and high-throughput techniques, Monitoring plastics in the food chain, Identification of markers in biological tissues

Béla Csukás, University of Kaposvár, Department of bio, environmental and chemical engineering, Kaposvár, Hungary
Agricultural and aquacultural systems

Heinz-Wilhelm Dehne, University of Bonn, Department of Phytomedicine, Bonn, Germany
Plant Protection, Research, Life Sciences, Molecular Biology, Biotechnology, Agriculture, Microscopy

Maria Doula, Hellenic Agricultural Organization Demeter, Department of Soil Science Institute of Athens, Lykovrysi, Greece
Waste production, Waste management

Yanqing Duan, University of Bedfordshire Business School, Luton, United Kingdom
Big Data and Analytics, Internet of Things, Artificial Intelligence, Digital agriculture, Sustainable food supply chains, ICT based knowledge management and transfer, SME’s adoption of emerging digital technologies

Snehasish Dutta Gupta, Indian Institute of Technology Kharagpur, Department of Agricultural and Food Engineering, Kharagpur, West Bengal, India
Plant Biotechnology

Victor Ella, University of the Philippines Los Banos College of Engineering and Agro-Industrial Technology, Los Baños, Philippines
Hydrology and Water Quality, Hydrologic Modeling and Simulation, Irrigation and Water Management, Soil Erosion

Camilo Franco, Copenhagen University, Department of Food and Resource Economics, Copenhagen, Denmark
Nanomaterials, thermal engineering

Longsheng Fu, Northwest A&F University, Yangling, China
Agricultural automation, Agricultural mechanization, Robotics, Machine vision, Deep learning

Wei Gao, The University of Auckland, Department of Chemical and Materials Engineering, Auckland, New Zealand
Wearable and flexible biosensors

Asa Gholizadeh, Czech University of Life Sciences Prague, Department of Soil Science and Soil Protection, Prague, Czechia
Precision Agriculture, Soil Science Remote Sensing, Earth Science, Machine Learning

Iqbal Gondal, Federation University Australia School of Science Engineering and Information Technology, Ballarat, Australia
Network Analytics, Remote Equipment condition monitoring, Wireless Communication, Ad hoc networks, Social networks, Sensor Networks

Qile He, University of Derby, College of Business, Law and Social Sciences, Derby, United Kingdom
Inter-firm alliances and partnerships, Innovation strategies and processes of organizations, Sustainable and responsible business, Inter-organizational knowledge transfer, Supply chain optimization

Yong He, Zhejiang University, College of Biosystems Engineering and Food Science, Hangzhou, China
Smart agriculture, Agricultural internet of things, Rural area informatization, Agricultural aviation, Intelligent agricultural equipment

Steven James Hoff, Iowa State University, Department of Agricultural and Biosystems Engineering, Ames, Iowa, United States of America
Evaluation of and design conditions for efficient and sustainable animal production systems

Klein Ileleji, Purdue University, Department of Agricultural and Biological Engineering, West Lafayette, Indiana, United States of America
Food, Pharmaceutical, and Biological Process Engineering, Data Science and Digital Agriculture

Raja Jurdak, CSIRO Robotics and Autonomous Systems Group, Brisbane, Queensland, Australia
Dynamic network modelling

Fatih Kalkan, Yuzuncu Yil University, Department of Biosystem Engineering, Van, Turkey
Plant architecture

Manoj Karkee, Washington State University, Department of Biological Systems Engineering, Pullman, Washington, United States of America
Sensing, Machine vision, Control, Simulation, Automation and robotics

Konstantinos Komnitsas, Technical University of Crete, Chania, Greece
(Bio)hydrometallurgy, low-grade ore processing, LCA, waste valorization, risk assessment

Weifa LIANG, City University of Hong Kong, Hong Kong, Hong Kong
Wireless sensor networks and Internet of Things (IoT) Mobile Edge Computing (MEC) and cloud computing Software Defined Networking (SDN) and Network Function Virtualization (NFV) Approximation and online algorithms Design and analysis of parallel and distributed algorithms Social networks and graph databases, Wireless sensor networks and Internet of Things (IoT), Mobile Edge Computing (MEC) and cloud computing, Approximation and online algorithms, Software Defined Networking (SDN) and Network Function Virtualization (NFV), Graph theory

Yubin Lan, USDA ARS, Areawide Pest Management Research Unit, College Station, Texas, United States of America
Machine vision, Intelligent agriculture

Won Suk Lee, University of Florida, Department of Agricultural and Biological Engineering, Gainesville, Florida, United States of America
Sensing systems for specialty crops for precision agriculture, farm automation, Global Positioning System (GPS), geographic information systems (GIS), near-infrared spectroscopy (NIRS), yield monitoring/mapping, variable rate fertilizer application, instrumentation, machinery, and agricultural mechanization

Jens Léon, University of Bonn, Faculty of Agriculture, Bonn, Germany
Molecular Markers

Changying Li, The University of Georgia Athens, College of Engineering, Athens, Georgia
Machine vision, Hyperspectral imaging, 3D imaging, High throughput phenotyping, Sensors, UAV, Robotics

Jonathan Li, University of Waterloo, Department of Geography and Environmental Management, Waterloo, Ontario, Canada
Photogrammetry and remote sensing, Geospatial data science, Artificial intelligence, Applied earth observation

Minzan Li, China Agricultural University College of Information and Electrical Engineering, Beijing, China
Fertigation, plant nutrition, agriculture, soil management, soil and crop sensing for precision crop production

Zhenbo Li, China Agricultural University College of Information and Electrical Engineering, Beijing, China
Computer vision, Intelligent agriculture, Image processing, Computer graphics, Virtual reality and human-computer interaction

Zhulu Lin, North Dakota State University, Department of Agricultural and Biosystems Engineering, Fargo, North Dakota, United States of America
Surface and subsurface hydrology and modeling, Soil and water resources management, Environmental systems analysis, Risk identifications and assessment

Shuangyin Liu, Zhongkai University of Agriculture and Engineering, College of Information Science and Technology, Guangzhou, China
Artificial intelligence, Big data, Intelligent information processing, Intelligent agriculture, Blockchain

Yongliang Liu, United States Department of Agriculture, New Orleans, Mississippi, United States of America
Study on Near Infrared Spectroscopy, Cotton Structure and Quality
Yaqoob Majeed, University of Agriculture Faisalabad, Department of Food Engineering, Faisalābād, Pakistan
Image Processing, Machine Learning, Smart Agriculture
José Fernán Martínez Ortega, Technical University of Madrid, Department of Engineering and Telematic Architectures, Madrid, Spain
Aggregate Farming in the Cloud
Gregory O'Hare, University College Dublin School of Computer Science and Informatics, Dublin, Ireland
Distributed artificial intelligence and multi-agent systems ( MAS ), Intelligent systems, Pervasive computing and wireless sensor networks research
Prem B. Parajuli, Mississippi State University, Department of Agricultural and Biological Engineering, Mississippi State, Mississippi, United States of America
Innovation on water-energy-food-nexus
Xi Qiao, Chinese Academy of Agricultural Sciences Agricultural Genomes Institute at Shenzhen, Shenzhen, China
Agricultural Gene Research
Thomas Rauschenbach, Fraunhofer Society for the Advancement of Applied Research, Ilmenau, Germany
Recirculating Aquaculture Systems
Francisco Rodriguez Diaz, University of Almería, Informatics, Department, Systems Engineering and Automatic Control Area, Almería, Spain
Frontiers in Control Engineering, ,
Claus Aage Grøn Sørensen, Aarhus University, Department of Engineering, Aarhus, Denmark
System technology, Operations management involving operations analyses, and modelling optimisation and evaluation of production systems and decision support related to operations
N. K. Sreelaja, Sri Krishna College of Engineering & Technology, Dept. of Master of Computer Applications, Coimbatore, India
Machine Learning, IT Security, Computational Intelligence
Da-Wen Sun, University College Dublin Food Refrigeration and Computerised Food Technology, Belfield, Ireland
Food green processing technology, Food rapid nondestructive testing technology, New food freezing technology and low carbon system construction
Ning Wang, Oklahoma State University, Department of Biosystems and Agriculture Engineering, Stillwater, Oklahoma, United States of America
Sensing and Control Sensor Network Precision Agriculture, ,
Paul Reese Weckler, Oklahoma State University Biosystems and Agriculture Engineering, Stillwater, Oklahoma, United States of America
Rural resilience and sustainability sensors, Food and crop processing
Qihao Weng, The Hong Kong Polytechnic University, Department of Land Surveying and GeoInformatics, Hong Kong, Hong Kong
Remote sensing, imaging science, GIS, urban ecological and environmental systems, land-use and land-cover changes, environmental modeling
Hong-Wei Xiao, China Agricultural University College of Engineering, Beijing, China
Agricultural engineering technology and equipment
Theodore Zahariadis, TEISTE, Electrical Engineering Dept., Athens, Greece
Wireless Sensor Network, Future Internet, Sensor Networks
Qin Zhang, Washington State University Center for Precision & Automated Agricultural Systems, Prosser, Washington, United States of America
Agricultural mechanization, agricultural robotics, agricultural cybernetics
Zhao Zhang, North Dakota State University, Department of Agricultural and Biosystems Engineering, Fargo, North Dakota, United States of America
Agricultural intelligent mechanization
Chun-Jiang Zhao, Beijing Academy of Agriculture and Forestry Sciences, Beijing, China
Precision resicion Agriculture, Agricultural intelligent system, Information technology, Decision support system
GUIDE FOR AUTHORS

Introduction
Information Processing in Agriculture is an international open access journal for the publication of advanced information technology for solving problems in agriculture and related industries, which include agronomy, forestry, aquaculture, animal/livestock science, plant science, environment and food processing, food safety and quality tracking, and so on. The information technologies, used in the aforementioned fields, are as following but not limited to: Smart Sensor and Wireless Sensor Network, Remote Sensing, Simulation, Optimization, Modeling and Automatic Control, Decision Support Systems, Intelligent Systems and Artificial Intelligence, Computer Vision and Image Processing, Inspection and Traceability for Food Quality, Precision Agriculture, The Internet of Things in Agriculture, Cloud Computing and Agricultural Applications.

Types of article
1. Original research papers
2. Review articles
3. Application notes
4. Book reviews

No page charges
Information Processing in Agriculture follows an author-pays open access model and your article will be freely available to all via the ScienceDirect platform. This charge is necessary to offset publishing costs - from managing article submission to typesetting, tagging and indexing of articles, hosting articles on dedicated servers, supporting sales and marketing costs to ensure global dissemination via ScienceDirect, and permanently preserving the journal article. The fee excludes taxes.

Authors will not be charged any publication fee now.

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 on Ethics in publishing.

**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 Research Council's Guide for the Care and Use of Laboratory Animals 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.

**Declaration of interest**
All authors must disclose any financial and personal relationships with other people or organizations that could inappropriately influence (bias) their work. Examples of potential conflicts of interest 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 title page file (if double-blind) or the manuscript file (if single-blind). If there are no interests to declare then please state this: 'Declarations of interest: none'. This summary statement will be ultimately published if the article is accepted. 2. Detailed disclosures as part of a separate Declaration of Interest form, which forms part of the journal’s official records. It is important for potential interests to be declared in both places and that the information matches. More information.

Please complete and upload the Conflict of Interest and Author Declaration form with your manuscript. Inclusion of this form is mandatory.

**Declaration of generative AI in scientific writing**
The below guidance only refers to the writing process, and not to the use of AI tools to analyse and draw insights from data as part of the research process.

Where authors use generative artificial intelligence (AI) and AI-assisted technologies in the writing process, authors should only use these technologies to improve readability and language. Applying the technology should be done with human oversight and control, and authors should carefully review and edit the result, as AI can generate authoritative-sounding output that can be incorrect, incomplete or biased. AI and AI-assisted technologies should not be listed as an author or co-author, or be cited as an author. Authorship implies responsibilities and tasks that can only be attributed to and performed by humans, as outlined in Elsevier’s AI policy for authors.

Authors should disclose in their manuscript the use of AI and AI-assisted technologies in the writing process by following the instructions below. A statement will appear in the published work. Please note that authors are ultimately responsible and accountable for the contents of the work.

**Disclosure instructions**
Authors must disclose the use of generative AI and AI-assisted technologies in the writing process by adding a statement at the end of their manuscript in the core manuscript file, before the References list. The statement should be placed in a new section entitled ‘Declaration of Generative AI and AI-assisted technologies in the writing process’.

Statement: *During the preparation of this work the author(s) used [NAME TOOL / SERVICE] in order to [REASON]. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.*
This declaration does not apply to the use of basic tools for checking grammar, spelling, references etc. If there is nothing to disclose, there is no need to add a statement.

**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 compliance, your article may be checked by Crossref Similarity Check and other originality or duplicate checking software.

**Use of inclusive language**
Inclusive language acknowledges diversity, conveys respect to all people, is sensitive to differences, and promotes equal opportunities. Content should make no assumptions about the beliefs or commitments of any reader; contain nothing which might imply that one individual is superior to another on the grounds of age, gender, race, ethnicity, culture, sexual orientation, disability or health condition; and use inclusive language throughout. Authors should ensure that writing is free from bias, stereotypes, slang, reference to dominant culture and/or cultural assumptions. We advise to seek gender neutrality by using plural nouns ("clinicians, patients/clients") as default/wherever possible to avoid using "he, she," or "he/she." We recommend avoiding the use of descriptors that refer to personal attributes such as age, gender, race, ethnicity, culture, sexual orientation, disability or health condition unless they are relevant and valid. When coding terminology is used, we recommend to avoid offensive or exclusionary terms such as "master", "slave", "blacklist" and "whitelist". We suggest using alternatives that are more appropriate and (self-) explanatory such as "primary", "secondary", "blocklist" and "allowlist". These guidelines are meant as a point of reference to help identify appropriate language but are by no means exhaustive or definitive.

**Reporting sex- and gender-based analyses**

**Reporting guidance**
For research involving or pertaining to humans, animals or eukaryotic cells, investigators should integrate sex and gender-based analyses (SGBA) into their research design according to funder/sponsor requirements and best practices within a field. Authors should address the sex and/or gender dimensions of their research in their article. In cases where they cannot, they should discuss this as a limitation to their research's generalizability. Importantly, authors should explicitly state what definitions of sex and/or gender they are applying to enhance the precision, rigor and reproducibility of their research and to avoid ambiguity or conflation of terms and the constructs to which they refer (see Definitions section below). Authors can refer to the Sex and Gender Equity in Research (SAGER) guidelines and the SAGER guidelines checklist. These offer systematic approaches to the use and editorial review of sex and gender information in study design, data analysis, outcome reporting and research interpretation - however, please note there is no single, universally agreed-upon set of guidelines for defining sex and gender.

**Definitions**
Sex generally refers to a set of biological attributes that are associated with physical and physiological features (e.g., chromosomal genotype, hormonal levels, internal and external anatomy). A binary sex categorization (male/female) is usually designated at birth ("sex assigned at birth"), most often based solely on the visible external anatomy of a newborn. Gender generally refers to socially constructed roles, behaviors, and identities of women, men and gender-diverse people that occur in a historical and cultural context and may vary across societies and over time. Gender influences how people view themselves and each other, how they behave and interact and how power is distributed in society. Sex and gender are often incorrectly portrayed as binary (female/male or woman/man) and unchanging whereas these constructs actually exist along a spectrum and include additional sex categorizations and gender identities such as people who are intersex/have differences of sex development (DSD) or identify as non-binary. Moreover, the terms "sex" and "gender" can be ambiguous—thus it is important for authors to define the manner in which they are used. In addition to this definition guidance and the SAGER guidelines, the resources on this page offer further insight around sex and gender in research studies.
Changes to authorship
Authors are expected to consider carefully the list and order of authors before submitting their manuscript and provide the definitive list of authors at the time of the original submission. Any addition, deletion or rearrangement of author names in the authorship list should be made only before the manuscript has been accepted and only if approved by the journal Editor. To request such a change, the Editor must receive the following from the corresponding author: (a) the reason for the change in author list and (b) written confirmation (e-mail, letter) from all authors that they agree with the addition, removal or rearrangement. In the case of addition or removal of authors, this includes confirmation from the author being added or removed.
Only in exceptional circumstances will the Editor consider the addition, deletion or rearrangement of authors after the manuscript has been accepted. While the Editor considers the request, publication of the manuscript will be suspended. If the manuscript has already been published in an online issue, any requests approved by the Editor will result in a corrigendum.

Copyright
Upon acceptance of an article, authors will be asked to complete a '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, it is recommended to state this.

Open access
Every peer-reviewed research article appearing in this journal will be published open access. This means that the article is universally and freely accessible via the internet in perpetuity, in an easily readable format immediately after publication. The author does not have any publication charges for open access. The China Agricultural University will pay to make the article open access. A CC user license manages the reuse of the article (see https://www.elsevier.com/openaccesslicenses). All articles will be published under the following license:

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 Language Editing service available from Elsevier's Language Services.

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.

Suggesting reviewers
Please submit the names and institutional e-mail addresses of several potential reviewers.
You should not suggest reviewers who are colleagues, or who have co-authored or collaborated with you during the last three years. Editors do not invite reviewers who have potential competing interests with the authors. Further, in order to provide a broad and balanced assessment of the work, and ensure scientific rigor, please suggest diverse candidate reviewers who are located in different countries/regions from the author group. Also consider other diversity attributes e.g. gender, race and ethnicity, career stage, etc. Finally, you should not include existing members of the journal's editorial team, of whom the journal are already aware.

Note: the editor decides whether or not to invite your suggested reviewers.

Additional information
Manuscripts should be prepared with numbered lines, with wide margins and double-spacing throughout, i.e. also for abstracts, footnotes and references. Every page of the manuscript, including the title page, references, tables, etc. should be numbered. However, in the text no reference should be made to page numbers; if necessary, one may refer to sections. Avoid excessive use of italics to emphasize part of the text.

PREPARATION

Peer review
This journal operates a single anonymized 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. Editors are not involved in decisions about papers which they have 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. More information on types of peer review.

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 lower-case 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 optional yet highly encouraged for this journal, as they 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 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.

**Graphical abstract**

Although a graphical abstract is optional, its use is encouraged as it draws more attention to the online article. The graphical abstract should summarize the contents of the article in a concise, pictorial form designed to capture the attention of a wide readership. Graphical abstracts should be submitted as a separate file in the online submission system. Image size: Please provide an image with a minimum...
of 531 × 1328 pixels (h × w) or proportionally more. The image should be readable at a size of 5 × 13 cm using a regular screen resolution of 96 dpi. Preferred file types: TIFF, EPS, PDF or MS Office files. You can view Example Graphical Abstracts on our information site.

**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.).

**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, it is recommended to include the following sentence:

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

**Nomenclature and units**

Follow internationally accepted rules and conventions: use the international system of units (SI). If other quantities are mentioned, give their equivalent in SI. You are urged to consult IUPAC: Nomenclature of Organic Chemistry for further information.

**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 build footnotes into the text, and this feature may be used. Should this not be the case, indicate the position of footnotes in the text and present the footnotes themselves separately at the end of the article.

**Artwork**

**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) regardless of whether or not these illustrations are reproduced in color in the printed version. **For color reproduction in print, you will receive information regarding the costs from Elsevier after receipt of your accepted article.** Please indicate your preference for color: in print or online only. Further information on the preparation of electronic artwork.

**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**
1. All publications cited in the text should be presented in a list of references following the text of the manuscript (and vice versa). The manuscript should be carefully checked to ensure that the spelling of author's names and dates are exactly the same in the text as in the reference list.

2. If reference is made in the text to a publication written by more than two authors the name of the first author should be used followed by "et al." This indication, however, should never be used in the list of references. In this list names of first author and co-authors should be mentioned.

3. Use the following system for arranging your references:

   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 book:


Reference to a chapter in an edited book:


Note shortened form for last page number. e.g., 519, and that for more than 6 authors, the first 6 should be listed followed by et al.

6. Do not abbreviate the titles of periodicals mentioned in the list of references; alternatively use the International List of Periodical Title Word Abbreviations.

7. In the case of publications in any language other than English, the original title is to be retained. However, the titles of publications in non-Latin alphabets should be transliterated, and a notation such as "(in Russian)" or "(in Greek with English abstract)" should be added.

8. Work accepted for publication but not yet published should be referred to as "in press".

9. References concerning unpublished data and "personal communications" should not be cited in the reference list but may be mentioned in the text.

10. 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.

11. 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.

Preprint references

Where a preprint has subsequently become available as a peer-reviewed publication, the formal publication should be used as the reference. If there are preprints that are central to your work or that cover crucial developments in the topic, but are not yet formally published, these may be referenced. Preprints should be clearly marked as such, for example by including the word preprint, or the name of the preprint server, as part of the reference. The preprint DOI should also be provided.

Reference management software

Most Elsevier journals have their reference template available in many of the most popular reference management software products. These include all products that support Citation Style Language styles, such as Mendeley. Using citation plug-ins from these products, authors only need to select the appropriate journal template when preparing their article, after which citations and bibliographies will be automatically formatted in the journal's style. If no template is yet available for this journal, please follow the format of the sample references and citations as shown in this Guide. If you use reference management software, please ensure that you remove all field codes before submitting the electronic manuscript. More information on how to remove field codes from different reference management software.

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.

**Special Issues and Article Collections**

The peer review process for Special Issues and Article Collections is also a single anonymized review process. All contributions will be initially assessed by the Editor-in-chief for suitability for the journal. Papers deemed suitable are then assigned to an external Guest Editor. All Guest Editors receive training on conducting peer review. The Guest Editor sends the manuscript to a minimum of two independent expert reviewers to assess the scientific quality of the paper. The Guest Editor makes a recommendation for the decision to the Editor in Chief. The Editor in Chief is responsible for the final decision regarding acceptance or rejection of articles. The Editor in Chief oversees the peer review process of all Special Issues and Articles Collections to ensure the high standards of publishing ethics and responsiveness are respected. Guest Editors are not involved in decisions about papers which they have written themselves or have been written by family members or colleagues or which relate to products or services in which the guest 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.

**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. When sharing data in one of these ways, you are expected 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).

**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.

**AUTHOR INQUIRIES**
You can track your submitted article at https://www.elsevier.com/track-submission. You can track your accepted article at https://www.elsevier.com/trackarticle. You are also welcome to contact Customer Support via https://service.elsevier.com. For journal related information, please contact Sharon at ipa_cau@163.com.