



Get Your Research Published



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The process of writing a research paper for publication can be long and challenging. Follow these suggestions for preparing your manuscript and avoiding some of the common pitfalls.

Your research has uncovered some findings that you believe are new and interesting and worthy of dissemination. This generally means publication in a peer-reviewed journal. For a first-time author, the publication process can be confusing and includes several decisions that need to be made: In what journal should you publish your work? What will you include in the paper, and what will you leave out? What is the critical new finding that you want your readers to learn from your paper?

This article explains the publication process and provides some basic guidance on publishing a research paper in a scholarly journal. Although examples refer to *AIChE Journal* and *Environmental Progress & Sustainable Energy (EP&SE)*, the overall process is similar for most journals. However, consult the instructions to authors for the journals to which you intend to submit.

(Editor's note: Keep in mind that *CEP* is a trade magazine, not the type of scholarly journal that is the focus of this article. *CEP* does not publish papers that report the results of experimental research, but rather seeks articles that provide generic, broadly applicable "how-to" guidance, best practices, lessons learned, etc. For more information on writing for *CEP*, go to www.aiche.org/resources/publications/cep/guidelines-authors.)

Getting started

First, you need to determine whether your findings are publishable:

- Is your work original? Have you done a thorough

review of the literature to know its place in the field and what sets it apart from previously published works?

- Is your work significant? Have you identified something that others would value? Does the work advance the state of the art? Does it offer a few compelling take-home messages?

- Is the work novel? Incremental work may advance the field, but is not sufficiently interesting to attract the attention of readers. Upper-tier journals seek to publish findings that advance the field, rather than just tweaking previous outcomes.

- Is the study sufficiently complete? While you may have determined something interesting and significant, do you have enough data to provide sufficient proof of concept? Remember that a main intent of the peer-review process is to confirm that the results are pioneering and supported by experimental measurements.

If you can answer yes to these questions, then you probably have something valuable to publish.

The next step is to determine what type of article is appropriate for your findings. Many papers are full research articles, which describe significant and complete studies. If you have findings that are particularly interesting and worthy of fast-track publication, you might want to prepare a shorter communication; *AIChE Journal* refers to these as *AIChE Letters*. A compelling finding that is new, significant, and "can't wait" for additional results may be — for example, a new catalyst that gives a step increase in activity or selectivity, or a new catalytic reactor design that

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achieves a step increase in product yield by eliminating a transport resistance.

Next, identify the other individuals who have been involved in the development of this research finding. Be sure to include all contributors as authors on the paper. But, do not add people to the author list if they have not contributed in a substantial way; in some cases, an acknowledgment may provide appropriate recognition. Once you have settled on the author list, be sure that all of the authors participate in the writing and review of the manuscript and agree on the submission venue.

Structure of the manuscript

Writing a manuscript is like telling a story. Your paper should first provide a convincing beginning to interest the reader, a thorough middle to relay the key points, and an informative ending to underscore the take-home message. Follow the common adage: Tell them what you intend to tell them, tell them, and tell them what you told them.

While each journal may have specific organizational requirements, virtually all manuscripts contain the same basic elements:

Title. A succinct descriptive title will bring attention to your work and can garner citations of your paper. Many journals publish an online table of contents and/or place articles into a preview state after they have been accepted but prior to formal publication. In those cases, the title may be the only information available to the reader. By incorporating appropriate keywords into the title, you improve the chances that your paper will be identified by search engines, bringing further recognition to your work. However, the title should also be short and concise, typically less than 15 words. It needs to convey the essence of your manuscript in these few words, making the task of writing the title very challenging. Spend the necessary time on this effort to craft an effective title.

Abstract. This is the second-most important element of your manuscript, since many journals make the abstract publicly available. The abstract is also relatively short, typically between 200 and 300 words. It should convey the two or three most important elements of your manuscript. The reader should learn in a few sentences the significant outcomes that you present in your paper, whether that is a key finding, a new method, or a new interpretation of previous outcomes. We recommend writing the abstract after

you have written the rest of the manuscript, so that you know precisely the most important elements of your submission. However, do not copy content from elsewhere in the manuscript to develop the abstract. Know those critical points and then write the abstract from scratch, developing proper sentences to summarize paragraphs and sections from the manuscript.

Keywords. Carefully select the keywords for your submission, as they will help the editor identify reviewers who understand your work and ensure your submission receives an appropriate evaluation. Keywords are also important tools to help boost the discoverability of your paper. With more than one million research articles published each year globally, it is important that you take an active role in making sure your paper is discovered and read. Employ search engine optimization (SEO) strategies that can help your paper move up in search engine results, such as strategically adding carefully selected keywords and key phrases in your manuscript. You can find tips on this topic on our publisher's website: <https://authorservices.wiley.com/author-resources/Journal-Authors/Prepare/writing-for-seo.html>.

Introduction. This is your opportunity to let the reader know why you conducted the study. It should summarize prior works in the field and how they relate to your results. Do not copy from those prior works, but rather synthesize the major points into key findings that are relevant to your topic. Once that is complete, you should be able to state precisely what is not known — which is the gap that your work is attempting to fill.

Experimental or Methodology. Whether experimental or computational, you followed a procedure to develop your outcomes. Provide that information in this section. Be thorough, so that someone reviewing your manuscript knows that you have carefully completed your experiments and feels confident that they could reproduce your results. State specific items of equipment, including model numbers, as appropriate. Describe all of the various experiments that you conducted, including any parameters that define how you operated the instrument. Your reviewers likely have similar equipment and know its pitfalls, so it is important to provide complete information in this section. In some cases, where space is limited, you may place some of this content into supplemental information, which will be included online but not available in the print publication.

Results. This section describes the outcomes of your work. It is often helpful to place the information in tables or graphs, so that the reader can see a summary of what was accomplished. Write a paragraph that describes each of those called-out items, identifying the key features that you want the reader to recognize. Keep in mind that you are trying to convince your reader of a few critical elements that are central to the paper. Therefore, use concise text to call out points

that may not be immediately obvious to a reader looking at them for the first time. This will help to focus the reader's attention on these details. This is not the proper place to present a detailed interpretation or analysis of the results — save that for the discussion section.

Discussion. While some journals might want you to combine the discussion with the results, we prefer separate sections. The discussion section is critical to the success of the paper. Here, you connect results presented in multiple figures or obtained by different experimental processes, and/or compare your results to those reported in previous publications, to support your analysis. This section brings your work together and guides the reader to reach the same conclusions that you did.

Conclusions. In the interest of conserving space, some journals no longer want a separate conclusions section, assuming that you will have previously stated the key outcomes as part of your discussion. If the journal allows a conclusions section, this is an excellent opportunity to remind the reader of the important outcomes. These are the takeaway points that are the basis of your paper — what makes it unique, interesting, and novel. This is your opportunity to remind the reader of the significance of your work. While there is some similarity between the conclusions and the abstract, these sections serve very different purposes and should be carefully constructed to meet their unique objectives.

References. You have identified prior work throughout your paper, primarily in the introduction, but also in the experimental section (where you described prior work with the equipment you used) and in the discussion (where you compared your results to related work). Your list of references should be complete, but do not include references simply for the sake of constructing a long list. Do not include references not cited within the manuscript. Finally, your citations should be presented in the journal's style.

Preparing your manuscript

The need to clearly convey to the reader the two or three most significant points of your paper cannot be understated. When preparing your manuscript, make sure that you arrange it around those key points, focusing on them throughout the introduction, experimental section (if applicable), results, discussion, and conclusion sections. Know what you want to say. Stay on task. Don't lead the reader away from the main message with unnecessary details. Focusing on the most important points will ensure good readability of your manuscript, and allow the readers to understand what you have accomplished.

Most research papers are written in third person, are fairly succinct, and include appropriate technical rigor. It is not normally acceptable to use colloquialism or to wax philosophical. Remember, you are trying to describe a tech-

The need to clearly convey to the reader the two or three most significant points of your paper cannot be understated.

nical outcome to a technical audience; they want to know what you have achieved without wading through comments that you cannot substantiate. Maintain a straightforward presentation, focusing on the content that you want to present and that you want the reader to understand. Going off on tangents, bringing in extraneous information, or making broad philosophical statements only distracts from the message you want to convey.

Reading articles in the journal to which you intend to submit is critical. If you find yourself citing prior work from that journal frequently, the journal is likely a good technical fit. Also consider the significance of your work and the impact factor of the journal. The more valuable you believe your work to be, the higher the stature of the journal you might aspire to be in. Stature may be measured by the impact factor, but not necessarily. Nevertheless, keep in mind that the more highly cited journals have high standards, so the likelihood of being rejected is higher. You need to balance the quality of your work with the expectations of the journal to give your manuscript the best opportunity to be accepted and published.

The papers previously published in the journal also provide you with important information on the journal's preferred writing style. For example, in *EP&SE*, we like authors to use headers that allow the reader to move quickly between sections of the paper and find important elements. We prefer third person, but do not specifically require it. The instructions to authors provide excellent and important guidance on how to organize your manuscript and the writing style for the journal. The closer you conform to what the editors and reviewers expect, the higher the likelihood of success in getting your manuscript published.

When preparing your manuscript, make sure that the English grammar is the best that you can possibly make it. Some manuscripts are rejected because the reviewers cannot decipher the grammar and, despite reasonable technical content, cannot determine the critical outcomes of the research. Microsoft Word includes a spelling and grammar checker. Although its suggestions are not always correct, they can serve as a good starting point. If you ignore the changes Word suggests, you need to be confident that you have the correct grammar and spelling. If you are not a native English speaker, work with someone who can provide a detailed review of the grammar. Have multiple people, including someone who has not participated in the research, read the manuscript for grammar and provide input into the quality of the written material. Finally, consider investing in an editing service that will

provide a professional review for a fee. For example, Wiley Editing Services (<https://wileyeditingservices.com>) provide support for language editing, translation, figure and table preparation, and formatting. It may be a worthwhile investment to avoid being rejected for poor grammar.

Submitting your manuscript

Once you have prepared the manuscript, you still have a bit of work to do before you are ready to submit it. This is a good time to go back to the instructions for authors to review the submission requirements. Read them again, and make sure that your manuscript conforms in every way to the journal's expectations. As editors, we rely on the submission being properly prepared as part of the preliminary review process. Check to ensure that the spacing is correct and that the figures and tables are embedded or placed at the end of the document, according to the guidelines to authors. Ensure that the length is within the acceptable standards, and if it is too long, move some of the content into supplemental material. We receive more submissions than we can possibly publish; a manuscript that blatantly disregards the submission guidelines is often rejected without review.

Have someone who did not participate in preparing the manuscript read it prior to submission. Because you are obviously the most familiar with your own research, you might inadvertently leave out information that would be

critical to someone less knowledgeable about the specifics of your work. A peer reviewer may be able to discern that information by context, but if they cannot and, as a result, draw incorrect conclusions, you are handicapping your submission. Having someone read your paper can help you to avoid overlooking those details that are important to the reviewers. He or she might also spot errors that you have overlooked. It is common for an author who has read and revised a manuscript numerous times to "see what is supposed to be there." A fresh set of eyes can often spot such mistakes. It may be helpful to let the manuscript "age" for a few weeks before you submit it. Removing yourself for a short time and then returning is another way to bring fresh eyes to the manuscript.

Make sure that your figures and tables are properly formatted and translate properly when converted to PDF. If the figures and tables are not available or are hard to read, your manuscript is likely to be rejected. Make sure that everything is converted properly and is completely readable before completing the final submission.

It is also valuable to complete a plagiarism analysis for your submission, since many journals now do this on a routine basis. We have had to reject papers because of their lack of attention to this critical issue. Senior authors may assume that the contributing authors, typically graduate students or post docs, have adhered to ethical practices. While some level of repetition is to be expected, since some common phrases appear in technical papers on a regular basis, you should not copy entire paragraphs, nor should your paper contain significant amounts of material that is substantially similar to other publications. Each journal has some level of repetition above which the editor will complete a detailed analysis. You don't want to trigger that type of analysis — the editor might reject your submission without even having it peer-reviewed for technical value.

During the submission process, you will also have an opportunity to include suggested reviewers and reviewers who should be excluded. If you know someone who has an established bias against your work, you can indicate that. However, we generally recommend not asking for specific reviewers to be excluded. The editor may be more knowledgeable about the subject of your paper than you think. In addition, the editor might look into why you requested that certain individuals not be reviewers, and this could bring a higher level of scrutiny to your paper during the review process. On the other hand, it is beneficial to include some suggested reviewers, especially individuals who are knowledgeable about your work but may not already be known to the editor.

In addition to the manuscript and cover letter, many online submission systems require you to answer a series of additional questions. Answer them completely and accu-

THE COVER LETTER

Your manuscript should be accompanied by a cover letter addressed to the editor that includes specific information required by the journal to which you are submitting. You will often be asked to assert that the manuscript is original, is not being submitted elsewhere, and is being made available exclusively to that journal. If you do not use that standard language, many journals will return the submission without review, as they will not waste their reviewers' time considering manuscripts that might ultimately be published elsewhere.

The cover letter gives you an opportunity to tell the editor why they should consider your manuscript. All journals are looking for manuscripts that are impactful, so in a few sentences explain what is new and interesting in your work. This is not an abstract or introduction, but rather an opportunity to sell the editor on the importance of your results.

State how the manuscript fits into the scope of the journal, especially if that will not be immediately obvious to the editor. Each journal focuses on a specific readership, and while you might have a significant technical contribution, it will not have the appropriate impact if it is not within the scope of the journal. Look at the aims and scope on the journal's website and relate your submission to the journal's scope.

rately. These checklists give the editor information about your submission that will help guide them through the evaluation and review process. Your job in the submission process is to ensure that all of your information is organized to make the editor's job as easy as possible, which will help the editor to support your submission through the review process.

Peer review

After your submission is accepted into the online system, the editor will begin processing the manuscript. There may also be a preliminary review by an assistant who ensures that all of the elements are included in your submission and that you have conformed to the journal's style.

The editor conducts an initial analysis to determine whether your submission is appropriate for the journal and should be sent for peer review. For example, a highly theoretical paper might not be the best fit for an applied journal, or the subject might not be appropriate or too highly specialized. The editor may try to determine if the research is sufficiently significant, unique, or novel. During this initial review, the editor is likely not reading your entire manuscript, but rather focusing on the title, abstract, and possibly the conclusions. This is one reason these sections of your manuscript are so important, and why you need to spend extra time preparing and reviewing them. The preliminary review also determines whether the paper adheres to the ethical standards of the journal.

The peer reviewers perform the detailed technical review. The editor will identify several experts in the field who will read your manuscript and offer their opinion of its technical quality. They will assess whether the manuscript is sufficient for consideration, focusing on several aspects of the submission:

- Is the manuscript novel and does it contain important work?
- Have the authors provided appropriate context and cited the important prior works in the field?
- Does the manuscript provide a clear statement of the research objectives and why this work is important relative to the prior knowledge?
- Are the results clear and understandable? Do they follow a logical progression that allows the reader to understand the work that was completed and why it was done?
- Are the experimental methods, the analysis of the results, and the conclusions reached valid and appropriate? Is statistical analysis used appropriately?
- Is the presentation of figures and tables correct? Are the calculations correct and do the models work?

Editors are not perfect at selecting peer reviewers, but they generally have enough information about your submission to be able to identify individuals with sufficient expertise to critically evaluate your paper. The editor typically invites three to five referees to evaluate your manuscript,

with two reviews normally required for a decision. The editor considers the reviewers' comments and recommendations when deciding whether to accept or reject a paper. It is not uncommon for the editor to get a variety of opinions from the reviewers, so the decision is not always straightforward.

After the review

Once the editor makes a decision on your manuscript, he or she will inform you of the next steps. Several outcomes are possible:

- *Accept.* This is very uncommon on the first submission, but may be appropriate for a resubmission.

- *Minor revision.* These revisions might be grammatical or formatting changes or minor technical clarifications.

- *Major revision.* If the reviewers have technical concerns that require further elucidation, you might be asked to make major revisions. This is the most common response that you are likely to receive on your initial submission. In some cases, the revised manuscript will undergo re-review.

- *Reject and resubmit.* Not all journals use this option. Those that do use it allow authors to resubmit their paper after making substantive upgrades, which might take several months to complete.

- *Reject.* The reviewers have raised significant technical concerns that will require additional work on your part, usually involving revisions to your analysis and/or more experimental work.

The decision letter will be accompanied by reviewers' comments, which can be highly critical. Don't take the comments personally, as they are intended to provide

DEMISTIFYING THE PEER REVIEW PROCESS

Some journals' peer review process is double-blind, in which the identities of the authors and the referees are unknown to each other. AIChE's journals typically employ single-blind review, in which the reviewers know the identities of the authors, but they remain anonymous to the authors.

As part of the growing trend toward openness in scientific research and publishing, a relatively new alternative is transparent peer review (TPR). TPR is a voluntary option that an author can select during the submission process. Under TPR, when an article is published, the reviewers' comments, the author's responses, and the editor's decision letter are also published, linked to the article, and given a digital object identifier (DOI) to make them fully citable. Reviewers can choose to remain anonymous or reveal their identities. AIChE's *Biotechnology Progress* and *Bioengineering & Translational Medicine* recently began participating in Wiley's TPR pilot program and now offer the TPR option to their authors.

information to help you improve the quality of the manuscript. Let the comments sink in before deciding how you want to proceed. Do not react too quickly, and don't let your emotions guide your response. Getting upset at the reviewers will not benefit you as you work to address their concerns. Remember that the reviewers are reacting to the information that you provided, and their comments may reflect a lack of clarity in what you wrote. The revision gives you the opportunity to sharpen the message.

If revisions are requested, you will receive instructions about what is required to address the reviewers' specific concerns. If you make the requested changes and resubmit the paper, include a point-by-point response to each of the reviewers' comments. It is helpful to remind the editor of the requested revision and then provide a specific statement regarding the changes that you made. If you decide that one or more of the comments cannot, or should not, be addressed, explain your rationale. Be thorough with your revisions and in your response, since the editor wants to ensure that you took the comments seriously. The goal of the review is to improve the quality of your manuscript and to make sure that it is technically accurate; your work through the revision process is critical to achieving that outcome.

If your manuscript is rejected, you will also receive comments from the reviewers. You can appeal the editor's decision, but we don't recommend this. The editor has considered the reviewers' comments and made a decision based on his or her own analysis, so it is likely that you will not have much success and will lose the opportunity to resubmit a revised manuscript. Consider and address the comments in a revised manuscript and then submit that. Since the online manuscript submission system considers the rejected-and-revised paper to be a new submission, you may not be able to submit your responses to the comments in a separate document, but you can include that information within the cover letter for the revised paper. It is always helpful to let the editor know that your submission is a revision based on reviewers' comments, so that they know that the manuscript has been improved from the previous version.

After acceptance

After your manuscript is accepted, you will likely be asked to complete a copyright transfer agreement (CTA) to transfer the copyright of your paper to the publisher. All of AIChE's journals offer the OnlineOpen option, an option that makes an article immediately available to everyone, including those who do not subscribe to the journal. To cover the cost of publishing OnlineOpen, authors pay an article publication charge (APC). Authors choosing this option retain copyright of their articles via a Creative Commons Attribution (CC-BY) license. Your manuscript will not be published without a signed CTA, so complete all of the

required documents quickly to ensure timely publication of your work.

Some research funders have unique agreements with our publisher, which are outlined on Wiley's Funder Agreements page (<https://authorservices.wiley.com/author-resources/Journal-Authors/open-access/affiliation-policies-payments/funder-agreements.html>). Authors with funding from organizations that mandate open access publication will be automatically directed to a CC-BY license. If you are affiliated with certain institutions from Germany, Norway, Austria, Hungary, or the Netherlands, your open access publishing fees may be covered.

You will receive a typeset version of your article (page proofs) to review and make sure there are no typographical errors or other minor typesetting issues that need to be corrected. This is not an opportunity to make substantial changes.

Standard practice is to publish your article electronically as soon as it is in the proper format, and then later place it into a hard-copy paper format (or into an online volume and issue if the journal is an online-only publication). Once the manuscript is published online, it is available for referencing through its digital object identifier (DOI). At this time, you can include it on your résumé or CV and, more importantly, link to it through your social media feeds or university website. Your goal at this point is to draw attention to your work and increase its impact. The better you have done at including interesting keywords in your title and abstract, the more

MARTIN A. ABRAHAM, PhD, editor-in-chief of AIChE's *Environmental Progress & Sustainable Energy (EP&SE)*, currently serves as Interim President at Western Illinois Univ. Before joining WIU, he was the Founding Dean for the College of Science, Technology, Engineering and Mathematics at Youngstown State Univ. and then Provost and Vice President for Academic Affairs at YSU. His area of research is sustainable energy and reaction engineering, and he has over 75 refereed publications. He earned a BS at Rensselaer Polytechnic Institute and PhD at the Univ. of Delaware, both in chemical engineering, and he is a Fellow of AIChE and the American Chemical Society.

MICHAEL P. HAROLD, PhD, editor-in-chief of *AIChE Journal*, is the ChBE Chair Professor and Department Chair of Chemical and Biomolecular Engineering at the Univ. of Houston. With expertise in reaction engineering and catalysis, he is the author of more than 170 peer-reviewed papers and book chapters and has given over 350 presentations and invited lectures. He is the founder and principal investigator of the Univ. of Houston's Texas Center for Clean Engines, Emissions & Fuels (TxCEF). Previously, he was an associate professor at Univ. of Massachusetts at Amherst, and he held several technical and managerial positions at DuPont Co. His honors include the 2013 Ester Farfel Award at the Univ. of Houston (the highest honor bestowed on a faculty member) and the American Chemical Society's Fuel Div. Richard A. Glenn Award. He received his BS at Pennsylvania State Univ. and his PhD at the Univ. of Houston, both in chemical engineering.

MIA RICCI is an executive editor in the Research Div. of John Wiley & Sons, where she manages a portfolio of high-profile journals in the physical, life, and health sciences, including AIChE's six journals. She has been at Wiley for more than 11 years, helping researchers and societies increase the impact of academic research. She holds a BA in journalism from the City College of New York.

attention the manuscript will receive after publication.

Consider other ways to promote your article once it is published, such as posting on social media, adding your article as a reference in a related Wikipedia page, and taking advantage of other promotional tools that might be available from the publisher of the journal. Authors published in AIChE's journals can take advantage of the promotional tools available through the Wiley website at <https://author-services.wiley.com/author-resources/Journal-Authors/Promotion/promotional-toolkit.html>.

As you promote your article, be sure to not violate copyright restrictions. Unless you have paid an article publication charge (APC) for open access publication of your paper, the publisher owns the rights to your published article, and the manuscript is considered published once it appears online in typeset format with a DOI. Many publishers will provide a share link that you can send to people who request access to your publication. The more you can share your article, the more likely it is to be cited by others and the greater the impact the article will have on your field, earning you a reputation as a scholar and researcher.

Closing thoughts

While the process of preparing, submitting, revising, and publishing your research can be long and arduous, the final product should be something in which you can take great pride. It is a record of your accomplishment, demonstrating something that has never been done previously. It provides a permanent record of your work, informs others in your field of your achievements, and establishes you as a qualified scholar within your discipline. Your publication provides you a certain level of prestige and distinction. Be sure you make smart choices in establishing and maintaining your research credentials through your publication record. **CEP**

FOR MORE INFORMATION

AIChE's Publication Committee sponsors a session entitled "Getting Your Research Published" at each Annual Meeting. Hear some of the editors of AIChE's journals discuss this topic and answer your questions.

This year's session will take place on Monday, Nov. 11, 1:30–3:00 pm, at the Hyatt Regency Orlando — Rainbow Spring I/II.

AIChE Publishing the latest research for the chemical engineering community

AIChE Journal is a high-impact home for quality research publishing on the most exciting technological advances in core areas of chemical engineering and related engineering disciplines.

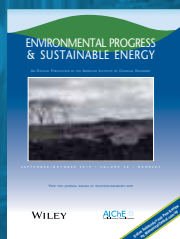
Driving impact in clinical practice and commercial healthcare products, **Bioengineering & Translational Medicine**, AIChE's fully Gold Open Access journal, provides rapid publication of quality research in chemical and biological engineering.

Biotechnology Progress focuses on research in the development and design of new processes, products, and devices for the biotechnology, biopharmaceutical and bioprocess industries.

For engineers and scientists, **Environmental Progress & Sustainable Energy** reports on critical issues of the environment, providing respected research in this important field.

With a clear focus on chemical and hydrocarbon process safety, loss prevention and health, **Process Safety Progress** is widely read by engineering professionals.

Journal of Advanced Manufacturing and Processing focuses on capturing leading-edge, new manufacturing techniques and technologies that create and provide unique solutions to improve and enhance societal well-being.



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