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Pearls for optimizing biomedical manuscripts

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Publication in biomedical research is essential for dissemination of relevant information and advances in science and medicine. The main currency for biomedical publications is the manuscript, which can be of various types, including but not limited to original studies, reviews, and case series. Biomedical writing for purposes of a manuscript is an art which builds on early linguistic and scholastic experiences and is honed throughout one's education, professional exposure, and training. Successful biomedical writing encompasses many considerations and steps, and along which various challenges exist that can impact an individual or group's ability to effectively conceptualize, develop, and submit a manuscript. Such challenges include limited research time, unfamiliarity with and expanding journal (or other receiving body) requirements, language barriers, insufficient biostatistical expertise, and others; despite these and other rooted and emerging challenges, there are well-established principles by which biomedical writing can be uniformly and successfully undertaken and completed.

In an effort to help investigators and authors allow their manuscripts to reach their full potential, here we provide pearls for optimizing both basic and clinical hepatology manuscripts, and by extension, other biomedical and scientific works. These pearls represent a synopsis of the requisite tools to prepare, submit, and successfully publish original, review, and other manuscript types.

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INITIAL CONSIDERATIONS

- Authorship is best decided *a priori* and in accordance with established consensus guidelines (e.g. International Committee of Medical Journal Editors) unless specified otherwise by the journal (or other periodical or book) of interest. Issues regarding authorship should, when possible, be resolved transparently among the authors, and, if needed, with direct input from the senior author.
- Choosing a target journal is a decision worth entertaining in the early stages of preparing a manuscript; choice of journal can affect not only the writing style and word counts but also the length of the review process, scrutiny of the review, and the size and nature of the downstream audience (i.e. readership). One objective metric in considering potential journals is the impact factor, whichreflects the ratio of the number of citations of the articles in a given journal to the total number of articles published by that same journal. The impact factor is used as a surrogate for the relative impact/reputation of a journal, with higher impact factors being deemed more reputable; however, in the era of the internet and open-access journals, the significance of this metric is not always clear and can be greatly influence by the field and scope of the journal (independent of its impact or merits).
- In addition to and perhaps before considering the impact factor of a journal, the choice of journal must be based on its scope and criteria for publication.

COMPOSING, TUNING AND TONING THE MANUSCRIPT

- The title, abstract and cover letter should be careful drafted. Many reviewers and editors base their decision on these components.

- A manuscript should tell a clear, coherent, and interesting story; for this, first constructing an outline is generally helpful. Each outline section could be written at different times, and the abstract or introduction need not be outlined first. Indeed, it may be most helpful to first formulate the hypothesis, approach, and expected findings.
- The structure of the abstract and the manuscript body depends on the type of article and the journal of choice. Experimental and observations manuscripts usually use the IMRAD structure (Introduction, Methods, Results, and Discussion) for the manuscript body.
- Provide context in the Introduction section while also concisely funneling down to the specific matter in question in the manuscript. This can generally be achieved in no more than three succinct paragraphs (and much less for the abstract). Further details and considerations can often be deferred to the Discussion section.
- Clearly describe the aim/objectives of the study in the last paragraph of the Introduction section, i.e. via a "thesis statement". This will provide the reader a sound idea of what hypothesis was tested and perhaps what to anticipate in the ensuing sections.
- Methods have to clearly explain study design, setting and subjects (inclusion and exclusion criteria), outcome measures, data collection and statistical analysis. Failure in the study design quality is the most important reason for manuscript rejection.
- If word limits permit, state the study design/type of study and data analysis in the abstract.
- For controlled studies, first describe the experimental group followed by control group.
- Ethical approval should be always included and documented in the methods section of original/experimental studies.
- Summarize the key and/or novel findings of the study in the (first and/or last paragraph of the) Discussion section. This should be concise but more detailed than the Conclusions section of the abstract.
- Avoid redundancy, e.g. instead of "Prospective, randomized controlled trial", "randomized controlled trial" would generally suffice given that by definition, randomized controlled trials are prospective. Similarly, avoid inclusion of Results-type information (e.g. "We recruited 156 patients for the present study.") in the Methods section and then repeating it in the Results section.
- Make certain that all figures and tables have self-explanatory titles and legends (i.e. they should be intelligible without having to read the manuscript text).
- For references, preferentially cite the primary literature sources rather than reviews articles. In addition, be certain to appropriate provide citations; plagiarism is a valid reason for rejection, and specialized software exists for its rapid detection.

GRAMMATICAL AND STYLISTIC PRINCIPLES

- Latin expressions and phrases, such as "*in vivo*" or "*a priori*" should generally be italicized. Abbreviations of Latin expressions, such as "e.g." (from *exemplum gratum*, meaning "for example") or "i.e." (from *id est*, meaning "that is"), need not be italicized, although this may depend on the particular journal.
- The proper abbreviation of the Latin expression "*et alii*" (meaning "and others") is "et al.", as opposed to "et. Al" or "et al".
- The term "data" is plural. The singular form of this term is "datum", which is seldom used in the English language. Therefore, authors should base verb conjugation, pronouns, etc. with this fact in mind, e.g. "The data presented herein are novel" or "These data suggest that iron deposition is reversible."
- Use of abbreviations should be minimized; abbreviations should simplify the reading experience rather than add more uncertainty or labor to it.
- When two independent clauses (i.e. clauses that contain a subject and a predicate [which at the minimum contains a verb]) and can thus stand by themselves) are present within a sentence, these must be separated by a comma. For example, "Liver tissues were rehydrated, after which we applied primary antibodies." Conversely, a comma is unnecessary if both clauses are not independent, e.g. "We rehydrated liver tissues and applied primary antibodies" or "Liver tissues were rehydrated and then treated with primary antibodies"; in both of these examples, the second clause did not contain a subject, hence a preceding comma was not indicated.
- Avoid using the passive voice. For example, write "patients reported their symptoms" (active) instead of "the symptoms were reported by patients" (passive).

FINISHING STEPS

- Read your manuscript in its entirety with special attention toward identifying (and subsequently revising) any sentences where you had to stop due to lack of clarity, flow, or other similar reasons. A well-polished manuscript will read seamlessly, whereas unintentionally-triggered pauses frequently suggest a need for revision.
- Allow co-authors ample time to review and provide critical input on the document/file(s) intended for submission.
- Inform co-authors of submission plans and obtain submission approval from them.
- Compose a cover letter which succinctly highlights the key findings and merits of the manuscript, thereby providing insight as to why the submitted manuscript would be a valuable addition to the journal/literature.
- Closely review the pre-submission PDF proof prior to clicking submit; many times residual errors can be detected at this stage and preventing from being passed along to the editorial staff and reviewers.

PREPARING TO SUBMIT

- The author instructions should be carefully read and diligently adhered to, with care to not provide insufficient or superfluous content. While seemingly simple and intuitive, failure to adhere to the author instructions are common and can result in delays in the review process or sometimes worse, including rejection of a submission; the Title page and References are among the most commonly problematic sections in this regard.
- Attention should be paid to word limits for the abstract as well as for the manuscript body. Some journals count the references section or other components (e.g. figure legends) toward the word limit, whereas others don't, thus highlighting the importance of carefully reading the author instructions.
- At the time of submission you should have on hand all the "administrative" information, including but not limited to: author affiliations and email addresses, funding sources and grant numbers, and conflicts of interest for all authors.
- When provided the opportunity to suggest an associate editor or reviewer, this must be done based on expertise in the manuscript subject matter and should not be someone from the authors' institution or a recent co-author.

RESUBMISSIONS

- Provide responses to the reviewers in a point-by-point manner and integrate, to the extent possible, their suggestions in order to improve the manuscript. When integration of a suggestion is not possible, it is generally preferable to substantiate why not.
- Highlight revisions in the manuscript as instructed (e.g. track changes, underlined font, etc.).

While not an exhaustive list, we believe the aforementioned constitutes a high-yield body of practical pearls and suggestions, particularly for early stage investigators and writers. We hope these will prove useful and help make the most of the hard work invested in biomedical writing, thus improving communication, quality, and advancements in our profession.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.