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EXTENDED ABSTRACT

**How to present and publish research results<sup>‡</sup>**

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**Abstract:** The end of each research is the presentation of its results to the public, especially to those who are engaged in similar research. This is particularly true for scientific research. A scientific paper is a written report that contains a presentation of the results of original scientific research. Its format is defined by centuries-old tradition of writing, the editorial practices of the publishers, scientific ethics, accepted standards and requirements of modern printing and publishing. Unfortunately, the experience of publishers and editors of scientific books and journals show that a large number of submitted contributions do not meet the minimum requirements to be even considered for publication. This article indicates the most important principles that one should bear in mind during the creation of a full text paper or presentation of scientific results.

**Keywords:** scientific paper; instructions for authors; creating tables; creating illustrations; article submission.

INTRODUCTION

It is noticeable that the real explosion of scientific research worldwide and the vast number of papers submitted each year flood the publishers with poorly written and poorly prepared articles. It is obvious that many authors, especially younger ones, have not acquired knowledge about how to write and to prepare technically a manuscript. This is confirmed by the increasing number of articles and texts which are devoted to this problem.<sup>1–8</sup> Before the decision to publish the results of a scientific research is made, two things must be kept in mind: first, there must be a clear and logical message to the readers, and second, the manuscript must be prepared in the required form. The first is, of course, much

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more important. No matter how carefully and well results are processed, if there is nothing important and significant to say, the work may be rejected. So, before writing or preparing a presentation, the results should be discussed with others dealing in the same or similar area of research, either in ones immediate environment or beyond.

#### *Creation of scientific manuscripts*

Any scientific paper, as a rule, should contain the following: title, abstract, introduction, experimental part (materials and methods), results (and) discussion and conclusions. Some journals do not require the existence of all these parts, or require some other with a similar name, but when creating manuscript, it is advisable to adhere to this structure. Each of these parts has its own characteristics and each of them will be discussed below. Before that, a few general remarks:

Firstly, the Instructions for authors and Artwork instructions (instructions for creating illustrations), must always be read and then the writer should proceed in accordance with these instructions.

It is recommended that a paper undergo editing before submission, either by someone who is conversant in the language in which the paper is written, or by a professional editor, especially if the writer does not know the language very well. Nevertheless, it is advisable that the manuscript be read by someone who is able to check the language. Of course, the final version of the manuscript should “pass” through the Spelling checker.

It is best to avoid jargon terms and acronyms (if it is necessary to use them, with the first mention in the text they must to be precisely defined, no matter how well-known they are)

Paying attention to the style of writing is strongly advised, some journals require writing in active (we are investigating...) not in passive (the investigation was carried out...).

#### *Title*

Title should be as short as possible and without unnecessary words such as study, research, analysis and so on. Indexing and database searches use words from the title and thus, the more accurate the title, the more successful is a search. If the article subject is a concrete material, chemical, species, area, region,..., it is beneficial to have their names appear in the title.

#### *Keywords*

Nearly always, the keywords in papers include parts of the title, which is completely wrong. Keywords are entered into the system for indexing (Indexing and abstracting services), as well as the title, so keywords should include some others words that will best indicate the content of the paper. This increases the likelihood that the paper reaches the targeted readers.

### *Abstract*

Abstract is a concise and comprehensive view of the whole paper. When writing the author should be guided by the aim: title and abstract must clearly describe the contents of the whole paper, it could be published independently of the paper (as, for example, in Chemical Abstracts or Current Contents). The abstract should not repeat the information clear from the title; any literature citations, tables, illustrations, acronyms, descriptions of methods or experimental procedures should be omitted. Abstracts should simply introduce the subject and the aims of the research, as well as the conclusions. Journals often limit the number of words in the abstract, but if such limit is 200 words, and all matters may be indicated by 100 words, there is no need to burden the abstract. The reader is most likely based on reading the abstract to decide whether to read the whole article or not!

### *Introduction*

In general, the introduction has a dual role: to introduce the reader to a review the literature related to the subject of the research and to present clearly the reasons and aims of the research presented in the paper.

Very often, the review of the literature is reduced to arid listing of relevant papers, without mentioning the main findings presented in them. Bearing in mind that this is the place where the reader first meets the essence of the research, the introduction should be easy to read, and the sentence should not be interrupted by citing the names of the authors and redundant phrases. It is best to cite the literature at the end of a sentence or phrase, whether by the names of the authors or a number from the list of references. The introduction must clearly show the need, the reason and the purpose of the research. The reader must have a clear idea of what kind and how significant are the contributions of the presented results.

### *Experimental (materials and methods)*

The aim of this part of the paper is to show all the procedures and describe all materials used in the research, in a way that the reader is able to repeat them in full. The scientific method of working means that the results are reproducible, so the reader has to get identical results if the details presented in this section are followed.

The employed equipment must be described in detail, including the model and the name of the manufacturer. The material should also be described in detail. For example, if the quality of a used chemical is affected by its origin, it is necessary to specify the name of the manufacturer. Modification or construction of equipment must be described in detail, as well as the methods of preparation of reagents or chemicals and methods used (unless it involves a well-known standard procedure, when it is sufficient to specify the relevant literature).

Whenever possible, experiments and measurements should be listed in chronological order, in order to avoid confusion of the readers. The best way to check the clarity and precision is to ask a person who is engaged in a similar area of research but had not participated in the study to read this section. When asked if they would be able to repeat the measurements based on what was written, the answer must be affirmative.

#### *Results (and) discussion*

Results and discussion can be presented in one or in two separate chapters. Some journals insist on either of the options, but the choice is usually left to the authors. The decision depends on personal preferences, but also on the content of the presented. Sometimes one way is more appropriate, sometimes the other way. In any case, it is desirable to follow some recommendations:

This section presents the obtained research results; figures and tables are the basis of this part of the manuscript. Data should be presented very concisely, stating the basic description of the most important trends and results. Since these results mean new information, *i.e.*, the contribution of the paper to the world, it is important to present them simply and clearly. In order to convey as much information to the readers, authors often burden this chapter with unnecessary details and lots of irrelevant information. Identical or similar information, which lead to the same conclusion, should not be displayed in both tables and figures; one or the other is enough. However, the presentation of the results should not be too concise; the reader cannot be expected to be able to draw conclusions from the text or to identify trends without your help. Hence, the text, images and tables have to be combined to highlight the most important findings and the most important data. When creating tables and figures, it is recommended to follow the Instructions for authors or Artwork instructions of the chosen journal. Otherwise, there is a possibility that the manuscript will be rejected for technical reasons, regardless of the value of the content.

The text should be easy to read, arid enumeration of facts and data makes the text incomprehensible and repugnant. Established and cumbersome phrases such as “Figure 1 clearly shows that the yield increases with reaction temperature” is better replaced with the sentence: “A greater yield was achieved with increasing reaction temperature (Fig. 1).”

Discussions need to show which general principles were established or confirmed by the research, which general conclusions could be drawn from it, and how findings have come to agree with expectations and the findings of other authors. Finally, the discussion should show the practical and theoretical contributions of the presented information.

It is crucial that the discussion directly refers to the evidence presented in the results. A clear reference to the results should be the basis for the discussion.

Conclusions should not go beyond that shown by the results. It is acceptable to make assumptions concerning the significance of the results on a global scale, but not to be the basis of this part of the manuscript. The discussion must be in accordance with the aims and objectives of the research set out in the introduction and the significance of the results should be clearly explained. After reading this chapter, the reader must not think, “Well, and what then.”

### *Conclusions*

It is not necessary that the conclusions exist as a separate chapter; it can be a logical completion of the discussions. Nevertheless, it should summarize the most important inferences set forth in the discussion and briefly explain the importance of the research. What and how it was investigated should be clear from the conclusions, together with the Abstract, as well as what new knowledge was revealed.

### *Nomenclature, physical quantities, units and measures*

The chemical nomenclature recommended by the IUPAC (International Union of Pure and Applied Chemistry) must be respected.<sup>9-14</sup>

Units of physical quantities must be in accordance with the International System of Units (SI). The official site of the International Bureau of Weights and Measures (Bureau International des Poids et Mesures), which is responsible for the system of units, is the best place for the elimination of all concerns regarding the choice of units.<sup>15</sup>

In accordance with the recommendations of IUPAC and SI, the appointment of physical quantities and their units can be twofold:

The designation of physical quantities must be in italic throughout the text (including figures, tables and equations), whereas the units and indexes (except for indexes having the meaning of physical quantities) are in upright letters. A slash should be used to separate the designation of a physical quantity from the unit, for example:  $p$  / kPa,  $t$  / °C,  $T$  / K,  $\tau$  / h. When it comes to complex units, and contain the fractional line, this unit must be placed in brackets, for example, units of concentration can be written as:  $\text{mg dm}^{-3}$  or as  $(\text{mg}/\text{dm}^3)$ .

If the full name of a physical quantity is unavoidable, it should be given in upright letters and separated from the unit by a comma (example: Pressure, kPa; Temperature, K; Current density,  $\text{mA cm}^{-1}$ ...).

### *Creating tables*

When creating tables the following should be born in mind:

The names and titles of tables, as well as rows and columns in it, must ensure that the table is completely clear, without reading the text of the manuscript.

The data presented in the text should not appear in the tables, and *vice versa*. It is wrong to repeat same data in tables and figures (charts or graphs).

A table that is not referred to in the text should not be used.

A table that can be explained simply with a sentence or two in the text is unnecessary and preferably avoided. In other words, a table with one column or one row is usually not required.

Quantities and units in the tables should be displayed with the smallest number of digits or letters.

Tables with the same value in the columns (rows) or with many empty cells, as well as large tables with lots of data should be avoided. This information is much better shown by graphs or diagrams

Highlighting important data in the tables in a footnote or in the titles of the table is advised.

Long titles of columns or rows should be replaced with abbreviations that are explained in a footnote to the table.

Except when necessary, it is best to avoid vertical lines between columns.

The instructions and requirements of publishers (if any) specified in the Instructions for Authors, must always be followed.

#### *Creating illustrations*

Caption must exist for every illustration. As a rule, it should be located below the illustration. It is recommended that a legend in the illustration be kept to a minimum, all the explanations, if needed, should be stated in the caption.

General recommendations for creating illustrations are as follows:

Each axis on the charts and graphs must be named, including units.

The length of the axis should be adjusted to the extent of the data presented. For example, if the maximum value shown in the diagram is 105, the axis should not extend above a value of 110.

Displaying images that are not cited in the text or that can be replaced with a few sentences is not advised.

Adherence to recommendations of IUPAC and SI is required.

The decision of whether to present an illustration in color or not depends on several factors: Printing color images in the paper editions of a journal is expensive and often has to be paid for by the authors (this information is usually found in the Instructions for Authors). However, in the electronic version of a paper, color illustrations are published without charge. In this case, two versions of the image can be prepared (in color and in black and white), if the publisher offers this option. For electronic journals (which are issued only in electronic form on the Internet), the choice of whether to prepare color or black and white illustration depends on the authors. In all other cases, it is advisable to prepare black and white illustration, unless it is necessary to be in color.

The size and format of illustrations must be in accordance with the requirements of the publisher. Some formats are unsuitable for printing on paper, and depending on the publisher, the allowed formats are limited. For graphics and diagrams (line-art), TIF, EPS, AI and PDF formats are usually allowed, while for photos and halftone image, JPG format is also allowed. Concerning combined images (line-art and halftone), JPG format is usually not allowed.

More and more publishers are allowing the inclusion of multimedia content in the electronic versions of works – videos, animations, sound recordings. As there are a number of multimedia formats, it is necessary to enquire about the possibilities offered by different publishers. Elsevier, one of the leading and largest publishers in the world, has very detailed instructions for preparing illustrations on its Web site.<sup>16</sup> Bearing in mind that many other publishers draw on the experience of Elsevier, it is a good idea to visit this site to gain knowledge of current opportunities, requirements and standards.

### *References*

For any data taken from literature, the source must be specified, immediately afterwards. The way in which references appear in the text, as well as in the reference list, differ from journal to journal, but they are always explained in detail in the Instructions for authors<sup>17,18</sup>. The authors are required to comply with these instructions!

If the entire part of the text is taken from the literature, it must be placed in quotation marks, while the list of literature must state the page number(s) from which the quotation was taken.

Publications that are not cited in the text must not be mentioned in the list of references. If the stated literature is written in a language different to that used in the paper, it must be indicated in the list, next to the reference.

### *Additional material*

Additional material can be joined to the article (Appendix or Supplementary material). It usually contains detailed information regarding the content presented in the text of the paper, which is primarily for a close group of readers who are engaged in a narrow area close to the subject of the article.

The existence of additional material must be indicated at the appropriate locations within the article. Spectra, measurement data, large tables, multimedia, *etc.*, are the most common contents of an Appendix. Frequently, the additional material is published exclusively in electronic form. The printed version of the article only mentions its existence and gives the Internet address where the additional material is located.



*Format, technical processing and submission of the paper*

Each publisher provides guidance for application and submission of manuscripts – Instructions for Authors, or Guide(lines) for Authors. The guidance describes how to write and to prepare technically a paper, how to create illustrations, charts or other specific contents. Very often, there are special instructions for the preparation of the graphical material – figures, diagrams, graphics, photos, *etc.* – called Artwork Instructions.

Before writing, one must ALWAYS read the directions and prepare the article according to the Instructions for Authors. Moreover, before sending, it is advisable to check once again whether the manuscript was prepared in accordance with these instructions. This not only saves the Editor's time and accelerates the process of manuscript evaluation, but also, more importantly, helps to avoid the possibility that the submitted paper be rejected for "technical" reasons. If the article used materials that are protected by copyright of the publisher (organization or individual), along with the submitted manuscript, the agreement of the rights holder that copyrighted material can be used, should also be submitted.

A supporting letter (Cover letter) must always be submitted in addition to the article. It must contain a statement that the research paper is original, not published or submitted for publication to another publisher and that does not contain copyrighted material (or if it does, refer to the attached agreement that these materials can be used).

*After paper submission*

After the article is submitted, it is likely that the author will obtain feedback that the paper arrived at the editorial office and a reference number will be assigned to the contribution. If there is no response after a few weeks, it is recommended to contact the editorial office with a brief e-mail in which the confirmation that the paper came to the office and the reference number of the manuscript is requested. The message should be addressed to the name of the editor to whom the manuscript was sent (especially if the journal has multiple editors).

After the reviews, the editor, or someone on behalf of the editors, will send a letter with the decision on the fate of the paper, usually along with reports of the reviewers. If the work requires revision, the comments should be read and each one should be answered, whether or not the author accepts or rejects them. No remarks should be ignored. In case a remark is not understandable, the editor should be contacted with a request to explain and/or clarify the instruction. Even asking for advice on how to revise the manuscript is appreciated, in this case.

In preparing the text of a manuscript text and the presentation of results, it may be useful to read the article by Bornman *et al.*,<sup>19</sup> which analyzes the process of the peer review of scientific papers and the contents of reviewers' reports.



*If paper is rejected*, before deciding what to do next, the Editor's report should be discussed with co-authors and colleagues. It is crucial to consider all comments of the reviewers and editors seriously. After additional measurements are performed and the manuscript is refined, it is ready to be re-submitted to the same, or if decided, some another journal. In the case that there are no valid reason for the rejection of the manuscript (rejection based on misinterpretation or misunderstanding of the content by the editor or reviewer), submitting an appeal to the Editor is welcomed.

*If the manuscript is accepted for publication*, information on copyright and reprints should be requested from the editorial office immediately, as well as any possible additional conditions of publications, if they are unknown. If the journal is charges for author's copies, it is often still possible to obtain a few free copies, but only if requested in due time. Finally, one should not forget to inform all of the co-authors that the paper will be published, and in which Journal.

## ИЗВОД

## КАКО ПРЕЗЕНТОВАТИ И ПУБЛИКОВАТИ РЕЗУЛТАТЕ НАУЧНИХ ИСТРАЖИВАЊА

АЛЕКСАНДАР ДЕКАНСКИ

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На крају сваког истраживања, посебно научног, потребно је добијене резултате представити јавности, посебно оном делу научне јавности који се бави сличним темама. То се најчешће чини кроз научни рад, писани извештај који садржи приказ резултата оригиналног научног истраживања. Његов формат је дефинисан вековима старом традицијом писања научних радова, уређивачком праксом издавача научних публикација, научном етиком, прихваћеним стандардима и захтевима савременог издаваштва и штампања. Нажалост, искуства издавача и уредника научних књига и часописа показују да велики број достављених прилога не испуњава минималне услове чак ни да се узму у разматрање. Овај чланак указује на најважније принципе које треба имати у виду при презентацији научних резултата писањем оригиналног научног рада.

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