

Editorial

## How to write a good scientific paper

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### How to write a good scientific paper?

To write a good scientific paper is a real challenge. There are at least two substantial reasons for this. The first one is that writing is usually not our routine line of work. The second one is that, for most authors, English is not their mother tongue. The latter problem may be solved by asking a person with a good command of English, preferably a native speaker, for help. This is what I am going to do after having written this paper. However, it is not enough to find a native speaker. Writing a scientific paper is something more complex than writing any other text. Therefore, it is advisable to ask an experienced scientist for help, preferably one specialized in similar aspects of medical physics or medical engineering.

How to start? For those who are writing their first or second paper, I recommend to write it first in their mother language, just to concentrate on the text itself, not on the English. Next, they should translate it into English themselves, or with the help of others.

When writing a paper, one should start by writing a good abstract. This is of particular importance, because the paper itself may be treated just as a much longer abstract. It is important to note that the reviewers, and likewise readers, usually begin to read each paper by reading the abstract. The structure of the abstract should follow the information for authors provided by the journal. In order to publish in the Polish Journal of Medical Physics and Engineering, the abstract should contain the following sections: Introduction, Material, Methods (or Material and Methods), Results, Discussion, Conclusions.

In the abstract, the Introduction should contain a brief description of our motivation. Why is our work important? Why should the paper be read by others? In the body of the paper, the Introduction must be longer. However, it should not be too long. Usually, the authors start with a few general statements concerning the subject of the paper. Next, a review of the literature should be included, be it shorter or longer. This is very important. It conveys to the editor and the reviewers the fact that the work has been carried out professionally. Real scientists acquire a thorough knowledge of the adequate literature before the beginning of a scientific project. Each scientist must also know what has already been done concerning the subject. This is also an excellent opportunity to

cite papers previously published in the Journal, which is particularly appreciated by all editors-in-chief. At the end of the Introduction, the authors usually describe briefly the aim of the work. In this context, it should be remembered that there must be something original in a paper. An alternative reason for publishing a paper is to confirm the results of other authors. However, there is no reason to confirm something which has already been confirmed several times by various authors.

The next two sections may be put together as one, designated as “Materials and Methods”. In the Materials section, the group of patients (animals in the case of a radiobiological study) on which the work has been based, should be described. As far as physics is concerned, the section may also contain a description of the dosimetry set-up or of the equipment used in the experiment, and of other materials used for the work, such as for example treatment planning systems or phantoms. The Methods section should contain information concerning the way in which the work has been carried out. This is also where the mathematical basis of the work should be presented. If the mathematical elaboration of the results is long and complicated, it can be presented in the Appendix. Whenever numerical data is presented in Materials and Methods, statistical methods used, if any, should be described. In the case of experiments performed with measurements, uncertainty issues should also be addressed. The Materials and Methods section should always be written in such a way as to enable others to repeat the study.

In the Results section, one should simply present the results. The discussion should be left for the Discussion section. However, a short comment may be added to each piece of information. Moreover, it should be remembered that there are several forms of presentation of data to choose from. Data may be presented in the form of graphs, tables or figures. The most appropriate form should be selected, one which allows a thorough and comprehensive presentation of the data. In addition, a clear description of all tables and graphs is very important. Excessively long tables should be avoided. Graphs should be presented in such a way as to enable the reader to see the results clearly (without using a magnifying glass!). In the case of the Polish Journal of Medical Physics and Engineering, which is also published on a website, graphs in colour may and should be made use of.

In the Discussion section, the results should be summarized. A discussion of how the aim of the work has been achieved must be included. More elaborated comments on the results are fitting at this point, preferably an analysis and commentary which takes into account results previously published. The strengths and weaknesses of the work might be discussed. Further research steps might also be suggested. References can also be cited here.

In my experience, and much to my surprise, the Conclusion section is frequently very badly written. There are of course various ways of formulating the conclusions, but there is one key point to make here. That is that conclusions should be linked directly to the results obtained. Meanwhile, authors often put forward their views, which are not necessarily substantiated by the results. A summary of the outcome of the work must form the bulk of the Conclusions section.

One more thing is very important, even for experienced scientists: write and revise your paper several times. Show it to your colleagues. Be open to constructive criticism!

Good luck!

Editor-in-Chief, Paweł Kukołowicz

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