

## *Guest Editorial*

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### ART OF WRITING A SCIENTIFIC PAPER

Research papers and reports are the means of scientific communication of the observations one has made. It is much easier to present a paper in a conference or symposium, but it is very difficult to put the same ideas or thoughts as a paper in peer reviewed journals. The papers once published have a long lasting impact whereas the verbal communications are short lived and generally have less impact. Hence, the written communication should be clear, complete, accurate, convincing and acceptable to the unknown critique. The papers in any standard journals are peer reviewed by the experts in the field and by the editors for their suitability.

Accumulation of data has no significance unless published otherwise. Thus, writing a paper is as important as doing the experiments. The real problem in writing is to begin. This is known as "Writers block" (1). Even the most experienced writers' find it difficult to begin but because of their experience they overcome the difficulties. They begin jotting down the thoughts as they come to their mind without worrying about their accuracy, grammar, expressions, etc. They are aware that they will be revising it many times before it is being sent for the publication (2). The personal computers have revolutionized the paper writing because they make the editing easy and friendly. The text, the graphs and the figures can be easily altered and edited once they are in the computers. Further, searching of literature through internet using PCs is easier, up to date and time-/cost- effective.

#### **Before writing**

Maintenance of a good protocol book is a necessity. When you have finished the experiments or a case study, it may be useful to record the conclusions on the observations made about that particular experiment/case. Accordingly, make tables, graphs and paste them in the protocol book. The spread sheet package like EXCEL enables one to store, sort, index, and analyze the observations. Keep a separate book in which the record of summaries of results from many experiments are maintained. The well ordered note books will be useful when you write a paper but the prompt recording of summaries compels you to give critical thought to each experiment at the best time and make you to repeat the experiments/observations when you still have the materials.

It will be beneficial to present your observations at the informal gathering within the group of like minded people. Speaking to others make you think the arguments and listeners criticism. This helps you to address the confusing points. Nothing clarifies ideas so much as explaining them to others.

**Arrangement of a paper**

The arrangement of a paper should be in such a way as to answer the questions set by Bradford (3). They are: Why did I start? (Introduction); What did I do? (Methods); What did I find? (Results); and What does it mean? (Discussion and conclusions). Thus, a scientific paper has a definite order having a Title, Abstract, Introduction, Results, Discussion, References, Tables, Figures and their legends. Most journals print methods before results but some print the experimental part in small type (font) at the end (e.g., *Neuron or Nature*) or as reference (*Nature*) or as the figure legends (*Science/Nature*). Some investigations are suitable for results and discussion to be written together in a narrative form. Many journals issue editorial directives that leave you no choice. Examine the chosen journal and arrange your paper accordingly: Do not give the Editor perhaps unpaid needless editing.

There are several categories of papers such as, Original Research Article, Short Communications, Clinical Reports, Rapid Communications, Review Articles, Letters to the Editors, Trends and Perspectives, Commentary, etc. The formats vary in each of them.

**Authorship**

Decide about the authorship in the beginning itself. This is an important issue. It is presumed that all the authors have contributed equally in the making of a paper. Usually, the person who has done the work will be the first author. The corresponding author is the person under whose guidance and ideas, the work has been carried out. There is no need to keep all persons in a group who might not know the contents of the paper.

**Where to start**

Even though you have the material, you might have postponed writing a paper despite the pressure from within and by your supervisor. Perhaps you find it difficult to start. This is called as "Writers block" (1). To overcome it, begin with the easiest section. This may be the Materials and Methods section, because it is just writing about the procedures used.

Next take up the Results section. Make Table(s) and Figure(s). Start describing them in order. Write the first draft in your own words as though you were telling a friend about your work. Don't worry about grammar and style. The important objective is to get going. You can polish the style later.

**Title and keywords**

Some researchers may read only the Title, hence it is an important part of the paper. If you can summarize your observations in one sentence, precisely that is the title. The title should be short and instructive and should not be general. Many Journals require an additional short "Running title". An ingenious paraphrase of the Title can supplement it.

The keywords should not be those present in the title. Therefore, select such words which are not present in the title that give coverage to your observations. The words such as "rats, cancer, human, clinical, etc" are not specific and may not project your observations.

**Abstract or summary**

Abstracts should be short and brief. In some journals the Summary is in numbered paragraphs and in many as a continuous text. Whatever may be the format, first sentence should define the objectives of the study. Next sentence should describe

methods used. Subsequently, list the results highlighting the main points. Last sentence should provide the conclusion of the observations. Usually the Abstracts are restricted to 150-200 words depending upon the Journal and nature of the article (Rapid communications, articles in Nature or Science have to be within 100 words). It is advisable to restrict the abstract to 250 words or lesser as the abstracts at Pubmed search are truncated to 250 words.

Write the *summary* in the past tense except perhaps the last paragraph. Do not give indigestible lists of values. Use words if you can, supplemented by few key values. State your conclusions in the last paragraph. If you have no plain conclusion, try to find the significance in any form. Remember that if a summary is long then the readers may look only at the first and last sentence and may not appreciate your observations.

#### **Introduction**

Introduction should state the problem, referred to the published literature and perhaps ask a question "Why did I do?" The objective must be clear. If you have modified your objective after you began the experiments, give the current version. In the last sentence it is good practice to state the lacunae which has lead you to undertake this work.

It is no longer good practice to quote many papers. Refer to the papers that indicate about the problem under study. Refer the paper that gives many references (review article) instead referring to all the references. However, beware of lifting references-from that paper-together with misquotations of information from the original papers.

#### **Material and Methods**

Write what you did in operational order.

You should so describe the methods such that others can repeat the experiments. You must be concise but must not omit the essential details. If a tube was heated, say to what temperature. If you have controlled, or even measured, humidity and ventilation in an animal room, say so. They are nearly as important as temperature. If you performed chromatography or other process at a slower or faster rate than usual, state the rate. If you have used controls mention clearly about their nature. The reader may not be able to guess what you omitted for each control.

If the description of the materials is brief it can be included in the Methods section at appropriate locations. Avoid trade names because they are not understood at the international level. This also avoids unnecessary advertising.

Follow the guidelines given by the appropriate and relevant ethics committee for conducting human or animal experiments.

#### **Results**

Begin with the description of the control observations. Provide a brief account of salient features in normal or control conditions. Subsequently, organize the results in such a way as to support your hypothesis or discussion. It is advisable to present the results as titled paragraphs. Each of these paragraphs should be able to provide the data of your observations. Arrange the tables and Figures in the same sequence so as to project your observations. Editors require tables and figures to be clear without reference to the text. The converse has also been expressed; the text should be clear without reference to the tables or figures.

In case of clinical data and also histological data it is not always possible to present them in a numerical form. Then, the

qualitative description for the pictures/plates/figures is required to show the differences before and after the experimental design. The observations in numerical form can be presented as mean and a measure of the variability (SD or SEM). Give the number of observations or the degrees of freedom. It is even better if you can make a pooled estimate of the variance from the whole experiment.

#### **Discussion and Conclusions**

Discussion is a vital part of the paper in which you have the greatest freedom. The discussion must not be long as to deter a potential reader, yet it must contain logical argument. Do not repeat descriptions of others findings if they are in the Introduction: refer to that. Usually, the discussion begins with a brief outline, highlighting the results so as to facilitate the reader about the findings of the experiments. Extensive repetition of the results is unnecessary and unwanted. Elaborate the findings of your results and their significance. Explain how your new results add to the existing knowledge. If in the Introduction you had formulated your problem as a question, discussion is facilitated when you can give the answer.

Think critically, not only about others work, but about your own. For example, ask your self, "Can my hypothesis be refuted? Can my results have another explanation? The literature contains abundant examples of inconclusive thinking. Writers should take care not add to them by publishing in haste.

If you are fortunate, your message or a part of it may survive in text books: although you may not be given whole sentence! So the conclusion needs a meticulous wording. This may appear legitimately two to three times, namely the

Discussion, Summary and Introduction (some times). Don't repeat the wordings: paraphrase it. If the reader has not understood, another version may help him.

#### **Acknowledgements**

Do not forget to acknowledge the persons who have helped you to get the materials, equipments and have read and improved your manuscript by critical reading. Acknowledge the funding agencies.

#### **References, bibliography or literature cited**

Writing, the Bibliography with a computer is much easier. Follow the format of the journal. The Endnote software that handles the references will be very useful as you can format the references in the prescribed format of a particular journal. Thus, there are no hardships as before. It is handy to have a hard copy of the abstracts from the literature database such as PUBMED when typing bibliography. Check the spellings of the authors and Journals.

#### **Literary style**

Written English at its best is virtually the same as spoken English at its best. Grandiloquent writing or the use of flowery language with too many adjectives is not required in scientific reports. What is required is to convey the ideas effectively, to make it easy to the reader, to make him understand and not to impress him with our vocabulary. Indeed, the writers who use pompous language may even be under suspicion of having nothing important to say! Try to envisage your reader. Write especially for them, in a manner not too technical and not too elementary. Write in clear English. Use ordinary words and simple construction. Write short sentences but not all of them so short as to produce

staccato effect. Cure a staccato passage by linking two sentences. Do this infrequently, so as to keep to “one idea per sentence,” with only occasional exceptions.

It will help you to develop a good written style if you train your self to speak well. In conversation speak slowly, chose words deliberately, finish each sentence. You should be able to offer more information per unit time than can he who talks fast but interjects “you know” or “Andrem” runs his phrases into almost interminable sentence padded with empty words.

Undisputed knowledge requires the present sentence. Author usually writes about his new work in the past tense. Others work is reported using different tenses but the present tense is most suitable. Working directions for a method are sometimes written in the active voice. This is done, not in the sense of getting commands but because it is the most direct style. The passive voice, although much used to describe the results, sometimes makes clumsy construction. Turn a passive phrase to direct style whenever you can. For example “pH 4 is needed for the enzyme” may be turned to “the enzyme needs pH 4” or as in “distillation was involved in the method” should be “the method included distillation”.

Present days most of the word processing packages have grammatical corrections. MS Word always helps you to correct spellings, language and usage. Try to incorporate them.

#### **Final preparation for online submission**

Now a day, many journals prefer to receive your manuscript online. The instructions given by the respective journals are self explanatory. You can get them easily by Google search using a search word such as “Instructions to author for <journal

name>”. Usually they require covering letter, manuscript text file, separate figure files (preferably JPEG or TIFF format), list of potential reviewers and additional/supplementary data which you want to share.

Prepare a simple covering letter to the Editor giving details of the enclosures. The file names, computer used and software are also to be mentioned. Most of the journals require no justification for the paper. However, journals such as, *Nature*, *Science*, *BMJ*, *Lancet*, etc., require a covering a letter justifying the suitability of the article for publication in their journal. In that case, highlight the findings by mentioning that, the observations are befitting to the Journal’s regular coverage.

MS-word format of the manuscript text file is usually preferred. Some times, one file of the manuscript including all figures and tables in PDF format is required by some journal at the time of submission along with separate files of figures and tables. In addition, high resolution format (>600 DPI) of the figures files are also required. The files in TIFF or JPEG format are accepted.

Many journals ask for potentials reviewers. You can prepare the list of persons working in your area. Use *Pubmed* or *google* search for details. If you feel that there is a conflict of interest, then clearly mention that it should not be sent to Dr. YYYY as it contradicts his/her observations and has a bias.

If the journal does not have the online facility to receive your manuscript, then the procedure is almost same except you will be sending the hard copy along with floppy diskette or CD. Prepare the document in the standard word processing package save the text file and Figures in separate floppy

diskettes or in CD. Some times the editors require the Copyright transfer at the beginning. If so, you have to send it along with the paper other wise as and when they require.

File all the papers including the final hard copy version or final approved PDF format of the paper for your records along with the CD containing the files. In case of online submission you will receive the reference number and confirmation of receiving your paper immediately. In case of postal submission you will receive the acknowledgement within 2–3 weeks.

After submitting the paper online/by post, celebrate the dispatch with your colleagues. Wait for the replies to come. Usually the review process is completed within 2–3 months. If the Editor or Reviewer asks for additional data or clarification of some points then, try to address each of the queries point by point. A meticulous planning is required at the time of

answering to the Referees Comments without hurting the Referee's self esteem. Give the list of answers separately, by identifying page and line numbers in which they are incorporated. This is very much required as the editorial office verifies them. Take sufficient time to revise and do not send the revised version in a haste. You also follow the other instructions given by the Editors at this time. After submitting the revised version, it is again a time for second celebration with a larger group.

Wait for the final acceptance by the editors. Once you receive it keep the final hard copy ready for proof reading (galley proofs). Now a days the galley proofs are sent electronically as PDF files. Correct them and send them as early as possible. Celebrate at a larger scale.

If your paper is rejected then format paper to the next suitable journal. Never loose heart, improve your manuscript and try again.

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#### REFERENCES

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