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Why authors have to use a rigid format for their journal articles

'*Proper words in proper places make the true definition of style.*'
Jonathan Swift

Medical writing is a creative process. It combines rhetoric and science to produce a piece of work that connects the scientific community with the general public. However, despite pressure to publish, many researchers dread the thought of medical writing. It can be an intimidating journey and hard work – and after all, where does one learn how to write a good science paper? Is there a recipe for success?

The answer lies in the IMRaD (Introduction, Methods, Results and Discussion) structure. This allows authors to organise and structure their work in an effective manner, which maintains the emphasis on the matter of good science.

Some may think applying such a structure is too formulaic and breeds mediocrity. Others may believe IMRaD allows authors to organise thoughts and ideas as well as helping them to remember to convey critical elements. That it makes evaluation of a manuscript easier for editors and reviewers and also allows readers to locate specific information without going through the entire article is less contentious.

Although the IMRaD structure may not reflect the order of scientific enquiry and activities, most journals continue to apply it to medical articles. It appears that having such a discipline to writing opens the doors to those who have not yet overcome their writer's block.

In the third article of the publishing series, Elisabeth Heseltine informs readers 'how to write'. Elisabeth became a scientific editor through science rather than language. She has worked as a researcher on the BBC science programme *Horizon*, as a proof-reader and then as a copy-writer. She is head of publications at the World Health Organization International Agency for Research on Cancer, in Lyon, France. She has edited many documents for other United Nations agencies and for research institutes around the world. She also runs workshops in scientific communication in over 30 countries.

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Papers submitted to biomedical journals usually follow a standard structure. This helps authors to remember what information to include and in what order and helps readers to find the information they are interested in. The chronology of how this structure was determined is outlined in this article.

Have articles always been formatted so rigidly?

Why do journals regulate the presentation of findings of original research in the papers they publish? It was not always so. Well into the twentieth century, journals such as *Philosophical Transactions of the Royal Society* contained discursive treatises on natural phenomena of all kinds. The articles had no particular form; they were essays on matters of interest to the scientific community.

When rules were first introduced – and why

In the 1950s, Sir Austin Bradford Hill, one of the first epidemiologists, published a paper in *The British Medical Journal*,[1] pleading for structure in the way in which scientific evidence was presented. He recalled that the process of scientific discovery starts with a question: What if...? How does it work? Why did this happen? Then, the scientist devises a means of answering the question: What method could I use to answer the question? What material would I need? Once the study has been done, there is some sort of answer to the question. What answer did I get? What does it mean anyway? Bradford Hill therefore concluded that readers of scientific articles require that the author answer four basic questions:

> Why did you start?
> What did you do?
> What answer did you get?
> What does it mean?

The philosophical treatises of the early part of the past century appeared as flows of unbroken text. Once the move to structure articles got under way, journal editors decided that dividing articles up into sections could help authors to organise their ideas and results and could also help readers, such as busy practitioners, to find specific information.

It took a while for the idea to catch on. John Maddox, then the Editor of *Nature*, wrote[2] that the article by Watson and Crick on the structure of DNA, which appeared in *Nature* in 1953[3] 'would probably not now be publishable. That article occupied just over half a printed page. While there are references to other work on the storage of genetic information, the suggestion that it must be DNA emerges like a rabbit from a hat. There is no substantial discussion of the proposal, merely the now-famous sentence: "It has not escaped our notice that the specific pairing we have postulated immediately suggests a possible copying mechanism for the genetic material." Today's referees would have clamoured for a fuller account of the reasons for considering the proposed structure seriously and an account of the implications.'

Formalising the IMRaD structure

Eventually, the answers to Bradford Hill's four questions became the

> Introduction (Why did you start?),
> Materials and Methods (What did you do?),
> Results (What answer did you get?) and
> Discussion (What does it mean?).

This IMRaD format is now the basis for almost all scientific articles published today.

As a result, most journals now require the following after the title page and abstract:

> an introduction that clearly poses the question being addressed in the article and should include a description of the inclusion and exclusion criteria, and a paragraph about statistics used;
> a materials and methods section that allows the reader to judge whether the question was approached thoroughly enough and with the appropriate tools;
> the Results section, which shows the reader that the question has been answered;
> the Discussion, which gives supporting and confuting evidence for the validity of the answer.

The IMRaD structure has proved so useful that it dominates original academic writing in the sciences. The style is not just a publication format, but reflects the process of scientific discovery. Advantages of the structure include:

> distinction of facts (Material and Methods, Results) from comment and theory (Introduction, Discussion);
> modular (rather than sequential) reading, especially in the digital format;
> easy location of material relevant to the reader's purpose;
> elimination of unnecessary detail.

Some have criticized the IMRaD structure as being too rigid and simplistic. Case reports, reviews, editorials and meta-analyses do not used IMRaD format, and readers are advised to check the journal's instructions for presentation of these types of article.

Styles for citing references

Most articles contain references to other published work to support the arguments made, to protect against plagiarism and to demonstrate that the author has carried out the necessary background research. Cited references allow readers to locate the material consulted.

Many styles can be used to cite a reference. The two most commonly used are the author(s)–date (formerly known as the Harvard) and the numerical (sometimes referred to as the Vancouver) systems.

In the author(s)–date system), the author(s) surname(s) and year of publication are given in parentheses after each citation within the text of the article. At the end of the article, the references are arranged in alphabetical order. This system allows the author to insert or delete references, but sequences of several references within one paragraph can make reading tedious.

In the numerical system, sequential numbers are inserted as superscripts or in parentheses within the text to refer to cited articles. In the reference list, the numbers are listed in the order in which they are first mentioned in

the text, tables and figure legends. It is more difficult to add or remove references with this system.

The instructions of each journal stipulate the system to be used throughout the text.

Authorship, formats and reporting guidelines

Although the IMRaD format became widely accepted, each journal had its own interpretation, with widely different 'Instructions to authors'. In 1978, a group now known as the International Committee of Medical Journal Editors (ICMJE) met in Vancouver, Canada, to standardise manuscript format and preparation, and published the Uniform Requirements for Manuscripts Submitted to Biomedical Journals. The ICMJE produced many editions of this document, and, over the years, addressed issues in publishing that go well beyond manuscript preparation, including authorship and conflicts of interest. The latest version[4] has been renamed *Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals* and was released in 2013 (www.icmje.org).

Most journals now adhere to the ICMJE guidelines, and it is recommended that authors also familiarise themselves with them. Doing so can help to avoid authorship disputes, prevent instant rejection because of incomplete presentation of research and ensure that an article rejected by one journal does not have to be re-written to comply with the instructions of another journal.

Electronic publication allows the addition of supplementary data, for which there may be separate requirements. All authors should be aware that they should adhere to the reporting guidelines that have been developed for specific types of study. These include:

> CONSORT for randomised trials;
> STROBE for observational studies;
> PRISMA for systematic reviews and meta-analyses; and
> STARD for studies of diagnostic accuracy.

Journals encourage authors to follow these guidelines because they help to ensure that a study is described in enough detail for evaluation by editors, reviewers and readers. Authors of review manuscripts are encouraged to describe the methods they used for locating, selecting, extracting and synthesizing data; this is mandatory for systematic reviews, as outlined by the EQUATOR Network.[5]

So, rules, rules, rules. But they help busy surgeons and others to find their way through the mass of information flooding even specialised fields and help to ensure that the information is complete and relevant.

Key questions

> Respect the well-established format of Introduction, Materials and Methods, Results and Discussion when writing original scientific articles.
> Always check the journal instructions to authors before submitting an article, including for references.
> Write in good, clear English.

References

1. Hill AB. The reasons for writing. *BMJ* 1965; **2:** 870.
2. Maddox J. Is the literature about to be readable? *Nature* 1988; **335:** 665.
3. Watson JD, Crick FH. Molecular structure of nucleic acids; a structure for deoxyribose nucleic acid. *Nature* 1953; **171:** 737–738.
4. International Committee of Medical Journal Editors. Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals. ICMJE; 2014.
5. The EQUATOR network: the resource centre for good reporting of health research studies (http://www.equator-network.org/).

Coming up next time

Anna Sharman did a PhD degree and gained postdoctoral experience in biology before going into journal publishing, working in-house and freelance for publishers such as BMJ, Public Library of Science, BioMed Central and Nature Publishing Group. In 2014 she launched Cofactor, a company offering editing, advice and training for scientific researchers to help them publish their work most effectively.