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## EDITORIAL

*Without publication, Science is dead*  
Gerard Piel

In science, scientists are not measured by their abilities, knowledge or ingenuity; they are measured and remain known (or not known) for their publications. A scientific experiment, no matter how spectacular the results, is not completed until the results are published; in fact, the cornerstone of the philosophy of science is based on the fundamental assumption that original research must be published; only thus can new scientific knowledge be authenticated and then added to the existing database that we call scientific knowledge. Thus the scientist must not only do science but must write science. Bad writing can, and often does, prevent or delay the publication of good science [1].

Scientific writing must be clear, especially when something is said for the first time. The publication of a scientific article is useless if it is not received and understood by the public to which it is directed, therefore a scientific experiment is not completed until its results have been published and understood. Clearly, writing should be as clear, simple and coherent as possible; Science must be communicated with words of unquestionable meaning and this must also be fulfilled for readers whose native language is not the author's own language. As well as organization, the second ingredient of a scientific article should be an appropriate language, considering that English has become the universal language of science [1, 2]. Because the end result of a scientific research is publication (by the scientist) and understanding of its results (by the community), it is the responsibility of the author to continue the interest throughout the communication process to achieve the task.

In prehistory, knowledge was lost as quickly as it was acquired, because it could not be effectively transmitted until appropriate communication mechanisms emerged. The first book known is a Chaldean account of the Flood, written on a clay tablet around the year 4000 B.C., preceding Genesis in about 2000 years [3]. The first medium of communication successful for being portable and lightweight was the papyrus, which began to be used around 2000 B.C. In the year 190 B.C. the parchment (made from processed animal skin) was used; according to Plutarch, the library of Pergamum contained 200,000 volumes in the year 40 B.C. [3]. In the year 105 A.D., the Chinese invented paper, the modern medium of communication.

However, until the invention of the printing press, knowledge could not be disseminated massively between generations and distant geographical points in the planet. Although movable types of printing were invented in China around A.D. 1100, the Western world attributes the printing invention to Gutenberg, in the year 1455 [3]. The first scientific journals appeared in 1665 when, coincidentally, two different journals: the *Journal des Sçavans in France* and the *Philosophical Transactions of the Royal Society of London* in England began publication; since then, journals have served as the primary means of communication in the sciences. Humans have been able to communicate for millennia. Nonetheless, scientific communication, as we know it today, is relatively new. The organization of the scientific paper called IMRAD (Introduction, Methods, Results and Discussion) has been created in the last 100 years. Currently, some 70,000 scientific and technical journals are published worldwide [1, 4].

The early journals published articles called "descriptive", often the observations kept a simple chronological order. By the second half of the nineteenth century, science began to move in more

complicated ways. Especially thanks to the work of Louis Pasteur who confirmed the microbial theory of diseases and developed methods of pure cultures isolation to study microorganisms. At that time, the methodology became extremely important to silence his critics, Pasteur found it necessary to describe his experiments with exquisite detail. As Pasteur's reasonably responsible peers were able to replicate his experiments, the principle of reproducibility of experiments became the fundamental tenet of the philosophy of science, and a separate section of methods led to the highly structured IMRAD format.

The logic of IMRAD can solve a series of questions such as: What question (problem) was studied? The answer is the Introduction. How was the problem studied? The answer is the Methods. What were the results or findings? The answer is the Results. What do these results mean? The answer is the Discussion. Now, the simple logic of IMRAD really helps the author to organize and write his manuscript, and offers a kind of clear road map to guide editors, referees, and final readers of the article.

Much has been discussed concerning the definition of primary publication (valid publication), from which the definition of scientific article is derived. The Council of Biology Editors (CBE) provided the following definition:

*An acceptable primary scientific publication must be the first disclosure containing sufficient information to enable peers (1) to assess observations, (2) to repeat experiments, and (3) to evaluate intellectual processes; moreover, it must be susceptible to sensory perception, essentially permanent, available to the scientific community without restriction, and available for regular screening by one or more of the major recognized secondary services (e.g., currently, Biological Abstracts, Chemical Abstracts, Index Medicus, Excerpta Medica, Bibliography of Agriculture, etc., in the United States and similar facilities in other countries) [1,5].*

An acceptable primary scientific publication should be the first disclosure. Such disclosure is only effective when it allows the author's colleagues to fully understand and use what is disclosed. For this reason, sufficient information must be presented so that potential users of the data can a) evaluate observations, b) repeat experiments, and c) evaluate intellectual processes (do the data justify the author's conclusions?). The disclosure must then be "susceptible to sensory perception". For example, for works published on a public website or available through any other retrievable source, many journals and associations such as ASM consider that it should be a genuine "publication" and that it should be prevented from being published in a journal. Regardless of the form adopted by the publication, this form should be essentially permanent, be available to the scientific community without restrictions and be available to information retrieval and dissemination services. Thus, publications such as newsletters, house organs, and limited circulation journals, many of which are useful for news stories or other features, cannot serve as repositories for scientific knowledge. In the CBE definition, the part of the definition that refers to "peers of the author" alludes to arbitration before publication. Thus, by definition, scientific papers appear in publications using arbitration.

The preparation of a scientific article has nothing to do with literary talent but with the organization. The writer of a scientific article is not really an author in the literary sense. Michaelson describes the organization forms of multiple types of articles and engineering reports [1, 6]. The publication of a research paper is a must-have obligation of scientific programs and professions; what is not written ... is not done [7]. The content of this editorial are excerpts from the reference [1].

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