How to Write a Rave Review

Pamela A. Derish[1]* and Thomas M. Annesley[2]

The Thomson Reuters (ISI) Web of Knowledge service lists data for nearly 7400 science journals. How many journals do you read on a regular basis? How many topics can you keep up with? If your answer to either question reached double digits, you are well beyond most scientists. The truth is that the number of papers published each year is so large that no one can keep up with the pace of science. If you want to gather even basic knowledge of a subject that is not within your immediate sphere of activity, you must rely on some sort of summary document that can bring you "up to speed" on the current state of a discipline.

This is the perfect role for a review article. Scientific review articles are critical analyses of available information about a particular topic. Unlike research articles, review articles do not present new data. Their purpose is to assess and put into perspective what is already known. Unlike research articles written on narrowly defined topics for a specialized audience of peers, review articles often examine broader topics for a more general audience. For example, a review of the extracellular matrix might be published in a journal whose readers are surgeons, rather than research specialists and pathologists with a greater knowledge of the topic, or it might be read by specialists who need to keep up with developments in related subspecialties. Many reviews, however, are written on narrow topics. For example, a review of mass spectrometry principles would be quite general, whereas a review of mass spectrometry in the clinical laboratory would be more specific and a review of the ionization effect in mass spectrometry would be even more specific.

There are 3 main types of review articles. The most common, which we discuss in detail in this paper, is the traditional narrative or "scholarly" review, in which the author evaluates and synthesizes what is already known about a topic. The problem with many narrative reviews is that they are vague and even eccentric in the collection, selection, and interpretation of the information they discuss. Often only a selected group of studies is considered ("cherry picking"), and the selection is quite likely biased. Because clinical review articles are often used by clinicians as guides for making decisions, many journals publish a second type, the systematic review. These reviews use explicit and rigorous methods to identify, critically evaluate, and synthesize all relevant studies in order to present a concise summary of the best available evidence regarding a sharply defined clinical question *(1–3)*. A review protocol defining the design and methods for a systematic review—including how studies or trials will be identified and the inclusion and exclusion criteria—is written before the review begins. A systematic plan is established to see that all relevant studies or trials (or at least as many as possible) are identified and included in any analyses that are done. A systematic review does not necessarily contain a statistical synthesis of the results from the studies included. The reviewer might find that the designs of the studies identified differ too greatly to permit the studies to be combined, for example, or that the results available for each study cannot be combined because of differences in the way outcomes were assessed. In such cases, the reviewer may simply report—as in a high-quality scholarly review—a well-reasoned but nonstatistical assessment of what might be drawn from the cumulative review. The third type of review article is the metaanalysis, which is a systematic review that uses a specific methodological and statistical technique for combining quantitative data from several independent studies. Established standards already exist for conducting and writing a systematic review or metaanalysis *(4, 5)*.

Scientific review articles are usually solicited by journal editors when they feel that some aspect of their journal's discipline has reached a point at which the research and findings in disparate studies need to be critically evaluated by someone competent to do a comprehensive assessment of the work, to separate the wheat from the chaff, to synthesize the ideas and findings the work comprises, and to bring an overall perspective to the field or topic. That person is usually a well-known and well-respected scientist in the field, although not necessarily an "elder statesman." Depending on the topic, the discipline, and the circumstances, journal editors might invite a review from a promising younger researcher when they expect the younger researcher to be more likely to consider the invitation a valuable career opportunity, to be more

[1] Department of Surgery, University of California, San Francisco, San Francisco, CA; [2] Department of Pathology, University of Michigan Health System, Ann Arbor, MI.

* Address correspondence to this author at: Department of Surgery, University of California, San Francisco, 1600 Divisidero St., Room C-322, San Francisco, CA 94143-1674. E-mail Pamela.Derish@ucsfmedctr.org.

thoroughly up to date on the current literature, and to have fresher ideas to contribute to the discipline.

From time to time a scientist may conclude that a review article in his or her discipline is long overdue. If you ever feel that to be the case, it is a good idea to check the information-for-authors section of the journal that most frequently publishes review articles in your discipline and, if the instructions do not indicate otherwise, to write a letter to the editor offering to write a review. Such a letter would detail why the review is needed at this time and why you are the person to write it.

The Keys to Writing a Good Narrative Review Article

Well-conceived review articles often answer a specific question, such as: What do we know (and not know) about the extracellular matrix? Or: How are outcome-related analytical performance goals established? Or: What are the pitfalls associated with clinical mass spectrometry? Both the topic and the purpose of the review should be clear from the outset, and one should keep the intended audience in mind when defining the review's purpose.

Draw up a plan or outline appropriate for the particular subject under review. Doing so helps you define the scope of the review, arrange the sections in a logical order, and avoid gaps and redundancies in your coverage of the topic. A series of subheadings should then be used to make the structure and organization of the review clear to the reader.

Evaluate all of the data and results from published studies, synthesize the evidence in the context of existing thought, draw conclusions, and use critical argument to support them. Many narrative review articles simply recite a litany of authors' names and findings that gives the reader little more than an expanded version of a bibliographic database search. The keys to a good review consist of the following: (*a*) your comprehensive review and critical assessment of the literature relevant to an important topic; (*b*) your criteria for selecting and omitting articles to include in the review; (*c*) your synthesis of the ideas other investigators in the field have generated; and (*d*) your disciplined scientific perspective—based on the preponderance of the evidence—on the status of the research and its findings, and the direction research must now take to advance knowledge in the field.

The Structure of the Review

Even though a review article is not a research article, the same important concepts that help you create a good research paper still apply. The title should clearly describe the topic and highlight what aspect of the topic is being covered. For example, the title "Thyroid Disease" would be too generic, whereas "Challenges in Diagnosing Subclinical Thyroid Disease" or "Challenges in Measuring Thyroid Hormones" would better describe the specific nature of the review. The abstract should stand on its own and include, at a minimum, the topic or question and the need for a review, what is included in the review, and conclusions about the topic or field at the end of the review. Abstract requirements for content and format differ, depending on the type of review and journal, so it is important to consult the instructions provided by the journal of choice. Some journals prefer unstructured abstracts, whereas others require structured abstracts containing several elements. For example, *Clinical Chemistry* requires a structured abstract with sections labeled Background, Content, and Summary. For clinical review articles, the *AMA Manual of Style* specifies the following sections: Content, Evidence Acquisition, Results, and Conclusions (*6*).

The Introduction should state the purpose of the review, why a review of the field or topic is needed at this time, and what you are going to cover, as is shown below in an example from a review on deep brain stimulation (DBS) for dystonia (*7*):

However, one must acknowledge that published results obtained with DBS in dystonia are few and that conclusions from these preliminary reports should be drawn very cautiously. Nonetheless, promising findings are emerging from single case reports or small case series, and the notion that DBS may be of great help in selected cases is progressively growing. . . . In this review, we discuss the results reported in the literature. Some critical issues regarding the evaluation of the results are also mentioned.

Whether you have done a narrative review or a systematic review, describe the methods for and the scope of your literature search for all reports on the topic since the last definitive review. In your description, include the key terms used for searches, the language(s) of articles searched, the limits of the search (e.g., inclusive years), the sources of references (e.g., computerized databases, prior paper databases, government reports), and manual searches conducted (e.g., of technical reports, dissertations). The following example, from a review on morbidity and mortality following pallidotomy in Parkinson disease (*8*), is fairly typical:

We searched the MEDLINE electronic database for English-language articles reported between January 1992 and December 2000 by using the key word pallidotomy. The reference lists of the relevant articles were scanned for additional studies.

Describe the inclusion and exclusion criteria for citing studies and how these criteria were established, as illustrated in the same example (*8*):

We selected studies according to the following criteria: 1) reporting of clinical data in Parkinson's disease (no radiologic procedures or technical notes), 2) reporting of original data (no reviews or editorial notes), 3) unequivocal description of morbidity and mortality, 4) and reporting of unselected consecutive cases (no case reports). For studies with overlapping data sets, we choose the one with the largest population. In the case of dual publication, the study was used only once.

Now you are ready to present the heart of the review, which consists of the main results or information gathered as part of doing the review and the commentary or discussion that pulls the information together and helps draw conclusions about the state of the field. This section is sometimes called Results and Discussion, or Results and Commentary but often starts with a major header that states the topic to be covered—for example, modes of action of protease inhibitors—followed by subsections (with appropriate subheadings) that review specific protease inhibitors or classes of them and categorize areas of increased understanding and knowledge since the last definitive review. Make sure the organizational principle of your review is explicit by stating the sequence in which topics are discussed—for example, chronological order, general to particular, or most frequent to rarest. Any included figures and tables should meet the same standards as for research papers.

Assess the issues surrounding the topic, the quality of the information available about the topic, problems that were not addressed, and areas of consensus or controversy. For each study, critically evaluate the following information: (*a*) the key findings; (*b*) the limitations and/or shortfalls, if any; (*c*) whether the methods are sound for evaluating the hypothesis; (*d*) whether the results can be obtained with those methods and are justified; (*e*) whether the interpretation of the results and the conclusions drawn are sound; and (*f*) the relative contribution of the work to the field or topic being reviewed. Summarize and critique the studies that warrant particular attention, giving appropriate credit to the studies that made important contributions and to the studies that yielded the most significant findings. Most importantly, synthesize and give shape to the ideas that have been found, as this example shows[3] (*9*):

Despite 30 years of continued investigation, the precise mechanism of CD4 T-cell loss induced by HIV infection remains controversial. HIV-mediated destruction of its preferred target, the activated CD4 T cell, is certainly central to HIV pathogenesis, but does not explain why many uninfected cells die or why the host cannot merely replace lost cells.[21,22] As first proposed in the 1990s,[23] researchers now know that the pro-inflammatory nature of HIV infection is a key part of disease pathogenesis.[2,25]

The discussion of current challenges or future prospects is the only area that allows the author subjectivity and opinion. If appropriate, you can also consider the scientific, economic, and social impact of the work reviewed, as in the following examples from 2 reviews published in *Clinical Chemistry*. This one is from reference (*10*):

The gold standard method for analysis of 17OHP, androstenedione, and testosterone is widely considered to be liquid chromatography–tandem mass spectrometry (LC-MS/MS). LC-MS/MS offers superior analytical sensitivity and specificity compared to immunoassay but is not without its own issues. In particular there is very little harmonization of methods between laboratories, necessitating site-specific reference intervals (31). As with plasma renin it is important that the same method and laboratory be used over time to assure that observed changes reflect physiologic change and are not due to differences in method. It is also important to note that although LC-MS/MS is highly specific, it is not free from interference. The use of ion ratios is an important tool to detect possible interference (31). MS methods are becoming more common in laboratories, and it can be expected that many institutions will switch to LC-MS/MS–based analysis of steroids in the near future. It is critical that clinical chemists keep clinicians informed when changes in methods occur to assure correct interpretation of results when monitoring CAH patients.

This example is from reference (*11*):

The results of a cost-effectiveness analysis, however, strongly depend on the relative cost of the CNH test compared with that of echocardiograms, as well as on the prevalence of HF in the population screened. Unfortunately, these factors can vary considerably among departments, countries, and healthcare systems; it therefore is probably necessary that each laboratory/clinical department analyzes the cost-effectiveness in its own economic framework. Furthermore, cost-effectiveness analysis is also dependent on the sensitivity of the CNH assay for detecting HF. Cost-effectiveness will improve if more specific assays are used: this would decrease the number of individuals with false-positive (FP) results and, consequently, the number of additional useless investigations.

End your review with a brief concluding paragraph or conclusion section that gives the reader a sense of "what it all means" or "what the future holds," as we show with 2 examples. This one is from reference (*12*):

Will MS-based quantification replace ELISAs? According to a recent report in Clinical Chemistry, *the consensus among experts is that ELISAs will likely not be replaced by*

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[3] The reference numbers in the examples do not correspond to any actual references in the present article.

MS-based methods in the clinic, but will serve in concert with immunoassays for quantification of certain proteins, in particular those for which ELISAs of good quality do not exist, or for those for which quantifying isoforms or posttranslational modifications is required (65). At present, the LOQs of MS-based methods lack reliable quantification in the ranges required for biomarker studies without being coupled with prior enrichment, depletion, and fractionation, as outlined in this review. However, these methods too have their limitations, and a more meaningful solution to alleviate the bottleneck in the biomarker pipeline will likely come about from advances in automated sample preparation, clean-up, and on-line fractionation, as well as improvements in mass accuracy and resolving power of the mass analyzers themselves.

This conclusion is from reference *(13)*:

Future studies evaluating novel stroke biomarkers should answer questions that address their unique clinical contribution in the diagnosis, management, and risk prediction of stroke: has the patient had a stroke? Is the stroke of ischemic or hemorrhagic etiology? Are symptoms suggestive of additional intensive investigation or thrombolytic therapy? Is the patient at risk for stroke or reoccurrence of cardiovascular events? Modern stroke diagnosis remains heavily reliant on clinical interpretation, and further translational research efforts toward discovery of stroke biomarkers have the possibility to greatly improve patient outcomes and quality of care.

Final Thoughts

A well-written research paper tells a story by answering important questions: Why is the topic important? What knowledge gap or controversy exists? How did I undertake the study? What did I find? What do the results mean? What can I conclude from the results? What recommendations can I make? Although a review article serves a different purpose than a research paper, a well-written review article also tells a story by answering similar questions: Why is it important to review the topic? What specific aspect of the topic needs a fresh look? How did I undertake the literature review? What did the literature show, and what does it mean? What can I conclude from my review? What recommendations can I make? If you keep these questions in mind as you write a review article, you should end up with a product that adds value to the field.

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