



How to Read a Scientific Article

Scientific articles can be viewed as contributions to an ongoing discussion about a scientific problem. The findings presented by the authors are always subject to interpretation and reevaluation. When reading scientific literature, keep in mind that the authors' interpretation of the evidence is only one way of looking at the problem.

Scientific articles have a structure that follows a predictable pattern. Thus, even though the language of scientific literature can be highly technical, and the methodology may seem obscure to those outside of a specialized discipline, it is nevertheless possible to read a scientific article in a systematic way so that you can abstract important information and discern the essential features of the argument presented by the authors.

A typical pattern is as follows:

- A brief summary of the article, called an abstract
- An introduction that defines the problem addressed in the article, explains why it is significant, and describes how the current research adds to prior work in the area
- A section that discusses the procedures, techniques, and supplies used in the experiments, labeled Material and Methods
- A results section that describes the researchers' findings, whether they are experimental data or a theoretical model, often using tables, graphs, or other types of illustrations
- A discussion section that draws conclusions from the data or the model, makes claims about its significance, and points toward further experimental work that might be undertaken or larger problems that might be addressed by researchers
- A list of references that cite published material the article draws on
- Additional information such as Conflicts of Interest, Acknowledgements, and Funding Sources are typically included at the end of the article
- Sometimes there are pieces of data that didn't make it into the main results of the article, but the authors believe they are still important. These are typically included as Supplemental Material or are available separately from the article.

Some questions you can ask yourself while analyzing a scientific article are listed below:

1. What is the purpose of this study? What is the problem that the authors address?
2. What unanswered questions raised by prior scientific work led to this study?
3. What are the major findings presented in this article?
4. If it is an epidemiological study, how was the study population or sample selected? Are there possible sources of bias in selecting the sample (e.g., are there factors that might make the sample unrepresentative? What are they?)

5. If it is a preclinical study, what experimental methods or models did the authors use? What specimens were used for experimentation? (i.e., blood, tissues, etc.) What controls were used, if any? How applicable are the methods/models to human breast cancer?
6. Do you think the conclusions of the authors were supported by the evidence presented in the paper? Why or why not?
7. What are the strengths of the paper?
8. Are there any obvious problems with the paper?
9. Can you suggest additional experiments that would strengthen the authors' conclusions?
10. Are the findings presented in this article meaningful? Why or why not?

If the study is describing results from a clinical trial, here are some questions you can ask yourself while analyzing the article:

1. Is it a randomized controlled trial?
2. What phase of clinical trial is it?
3. Does the trial address an important question or an unmet patient need?
4. What is the standard of care outside the trial, and was it used in the control arm of the trial?
5. What were the primary and secondary endpoints that were measured? Did the trial measure overall survival and/or quality of life?
6. Is it well-designed, blinded, and powered to measure clinically meaningful outcomes (i.e., overall survival and/or quality of life)?
7. Did the study allow for or mandate crossover, and was it appropriate? (Note: crossover should occur when a treatment has demonstrated benefit in a later line of treatment in oncology trials and the study is testing whether the treatment should be moved to an earlier line of therapy. Crossover should not occur if the treatment is new and has not yet been studied and shown to be effective.) What post-protocol treatments were available to patients in each of the arms of the trial?
8. How meaningful are the results for clinical outcomes?
9. Are the results of all pre-planned analyses reported?
10. What subgroup analyses were conducted and were these pre-planned analyses?
11. What are the side effects/toxicities?
12. Do the benefits of the treatment outweigh the potential risks and costs?
13. Who funded the trial? Are there financial interests that may alter how the data are interpreted by the authors?
14. Were medical writers involved in the drafting of the article?