

## CRITICALLY READING SCIENTIFIC PAPERS

As you progress through your courses in biology, you will be expected to delve further and further into the scientific literature. This course is no exception. For many of you, this will be your first time dealing with the primary literature, therefore an introduction will be helpful. Scientific papers usually have 6 main sections (more or less): abstract, introduction, materials & methods, results, discussion, and conclusion. Each section contains certain information and has its own purpose – the abstract is a summary; the introduction, results, and conclusion are exactly what they sound like; the materials & methods outline the procedure followed in the experiment; the discussion interprets the data in the results and puts it into a bigger picture. Depending on the discipline, some of these sections may be combined and specific details of information in each section may change. For example, in ecology interpretation of results is strictly contained in the discussion, while in genetics it may appear in the results section.

You'll also find that there's a difference between reading a paper and reading a paper critically. With the former, you take everything at face value. With the latter, you may question some of the things written in the paper. By the time you get to your comp, you should be critical readers, but for now, we'll get started with just reading.

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1. Read the paper once. Do not highlight or mark the paper. Don't worry if you don't understand everything – you won't. The idea is to get the general gist of the paper.
  2. Read it again. This time, take some notes to enhance your understanding, highlight, underline – whatever you are comfortable with. If you don't understand something, write it down!

Now that you've done that, answer the following questions:

3. Is the title of the paper specific and informative?
4. Does the Abstract include the most important points of the paper?
5. Does the Introduction state the main objectives and hypotheses of the research? What was it?
6. Is there enough information in the Materials & Methods section to repeat the experiment correctly?
7. In the Materials & Methods, did the author explain the procedures for collecting all of the data presented in the Results section?
8. Are the figures and tables numbered consecutively?
9. Is every figure and table referenced correctly in the text?
10. Does the data presented in each table concur with the in-text explanation?
11. Do any tables or figures present conflicting data?
12. Are any of the figures or tables unnecessary?
13. Does the author use consistent language in the text, figures, and tables?
14. Is each table and figure understandable apart from the text?
15. Are any data explained in the Introduction or Discussion that are missing from the Results section?
16. Are there any headings and/or subheadings in the paper? If so, do they help guide the reader through the paper?
17. Does the Discussion explain and INTERPRET the major implications of the research?

18. Have the authors considered problems, inconsistent results, and counter evidence in the Discussion?
19. Can you identify an alternative explanation for the results that the authors did not consider?
20. Do you feel that the authors cited enough sources? Were there any places where you wanted to know information, but it wasn't given?
21. Are all of the sources cited in the text listed in the Literature Cited section of the paper?
22. Does the reference list include any sources that were not cited in the text?
23. Why do you think this paper was published? What is interesting or unique about it?