

MERIDIANS

The Journal of
Acupuncture and
Oriental Medicine

Five Studies on Scientific Writing

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(Reprinted with permission from *The American Acupuncturist*, vols. 63-67)

The Abstract Section

The abstract in a scientific paper is a short advertisement of what is included in the full text of a paper. Your abstract should provide pertinent information and entice the reader to read the full text. Because most readers of scientific journals are busy people, they will peruse only the titles and the abstracts to find out what has been researched and what the results were. If the research is presented at a conference, the abstract will be the only part that will be published.

The abstract is what is used to index research papers in an online database, so it's important to include key words that will help researchers find the paper using a search box. An abstract should be short and simple, 200-300 words. Most journals will provide a word limit in the author guidelines. Do not include references. If the reader might not be familiar with certain illustrations or abbreviations, do not use them.

Writing Style:

When preparing the abstract, it is customary to use past tense sentences and a passive voice. In the last decade some scientific journals are encouraging authors to use a first-person active voice in their manuscripts, but most researchers who were educated after 1920 and before 2000 were taught passive writing style. In the next issue I will discuss in more detail both the history and current trends in scientific writing styles. For more information now, please visit:

<http://www.biomedicaleditor.com/active-voice.html>

Some authors prefer to write the abstract as a free flowing paragraph. Some journals require headings in the abstract. Headings are as follows: Background, Methods, Results, Conclusion.

The abstract should follow this format:

1. Background: State the purpose of the research—what is already known about the subject, what is not known, what the study is intended to examine, or what the paper is presenting.
2. Methods: Describe the methodology—include sample size, numbers of patients in different groups, interventions (ex. acupuncture group vs. placebo group), and duration of the study.
3. Results: Report the major findings; this section should contain as much detail about the findings as the journal word count for the abstract permits. Include results of both the primary and important secondary analysis both in words and by listing *p* values in parentheses. Provide numerical information on analysis: means and standard deviations, response rates, negative findings, and report on adverse events.* If available, report statistical information, such as effect sizes, relative risks, numbers needed to treat, and confidence intervals for each.
4. Discussion and Conclusion: This is the take-home message of the study. Normally only the primary findings are discussed. In some cases important secondary outcomes can be mentioned. Authors should not make blanket statements and claim more than their data demonstrates. For example, if you are reporting data on the impact of acupuncture on fatigue in breast cancer patients undergoing chemotherapy, do not conclude that “acupuncture improves fatigue.” Instead, the concluding statement should directly relate to the study and should read like this: “This data supports the use of acupuncture as a complementary treatment option for fatigue in breast cancer patients undergoing chemotherapy.”

* In AOM research, it’s important to include a statement on adverse effects. If no adverse effects were reported by the subjects, state that in the results section of the abstract. (ex. “No unexpected adverse effects were associated with the treatment.”)

Additional resources on writing a scientific abstract:

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3136027/>

<http://owl.english.purdue.edu/owl/resource/706/1/>

<http://classweb.gmu.edu/biologyresources/writingguide/Abstract.htm>

The Introduction Section of the Scientific Paper

Scientific writers are often so passionate about their subject that they tend to overdo the Introduction section. It should be 1–4 paragraphs long or no more than one page. In this section, don't discuss specific techniques (acupuncture, herbs, cupping). However, if you are using a totally new, not previously used approach to treatment that the readers are probably unaware of, you should present this here. Discuss the benefits, or possible benefits, of the new treatment or method you are using.

One of my mentors told me to think of the structure of the introduction as an upside down triangle. The most general information about the topic should be at the top of the triangle, then make the information more and more focused as you discuss the specific problem you explored (middle of the triangle). Your statement of purpose and the rationale for doing the study should be at the bottom tip of the triangle.

Top of Inverted Triangle:

Clearly identify the subject that you are studying. Use key words, perhaps taken them from your title. Be careful not to add information that is too general or strays from the specific topic that you are discussing. Summarize what is already known by reviewing several previous studies that have been done on this topic. Be sure to references those studies. Cite randomized controlled trials, meta-analysis and review papers. Stay on track; don't lose focus of the specific topic you are writing about.

Upper Middle of the Triangle:

State the purpose of the study and your hypothesis regarding what the outcome might be. Clearly explain what you investigated.

Lower Middle of the Triangle:

Why did you choose to study this topic? Why did you choose this type of experimental design? Why will this study answer the question you have on the specific topic? How did you approach the problem (the unanswered question)?

Bottom Tip of the Triangle:

Discuss how this study will contribute to the scientific literature by answering previously unanswered questions relating to the topic.

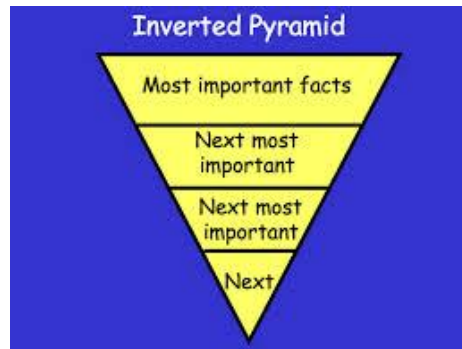
Links to more information on the structure of the scientific paper and writing the instruction section:

<http://mhhe.com/biosci/genbio/maderinquiry/writing.html>

<http://abacus.bates.edu/~ganderso/biology/resources/writing/HTWsections.html>

<http://umech.mit.edu/freeman/6.021J/2000/writing.pdf>

<http://beamlab.tamu.edu/Writing%20Tips/Dr.%20Shao/How%20to%20write%20a%20scientific%20journal%20paper.html>



The Materials and Methods Section

A scientific paper is usually comprised of these sections:

Abstract
Introduction
Materials and Methods
Results
Discussion/Conclusion
Acknowledgements
Literature Cited

Scientific writing is direct and orderly. The materials and methods section structure should:

- Describe in detail the materials used in the study and include all tools: needles, herbs, surveys and questionnaires. (It's not necessary to include all questions in the questionnaire if it is a proven measure previously used in research (ex. SF-MPQ, FACIT, etc.))
- Describe the human subjects, age, eligibility criteria, demographics, etc.
- If you did a field or survey study, provide a description of the study site, including the precise location, town, state and country. If an online internet survey was used, include details on who received the surveys, inclusion/exclusion criteria,

how many surveys were sent out, how many were completed and returned, how many were included in the data analysis.

- If the manuscript is a meta-analysis or review, include the search engines and scientific databases that were searched and the inclusion/exclusion criteria for the studies that were discussed in the results section.
- Explain how the materials were used in the study
- Describe the research protocol. Include how subjects were randomized (ex. numbers picked out of a hat or block randomization). Include controls, treatment, variables that were measured, etc.
- Explain how the data were collected, how measurements were made, and what calculations were performed
- State which statistical tests were done to analyze the data

The materials and methods section should always be written in past tense and in 3rd person. The description of preparations, measurements, and the protocol should be organized clearly and chronologically. Only include information relevant to the description of the materials and methods. Do not include any personal thoughts in this section; only describe what took place. Personal thoughts should be reserved for the discussion section.

A materials and methods section should clearly explain the details of the study so that another researcher can read the manuscript and replicate the study exactly. In acupuncture research, remember to describe what brand of needle was used including: manufacturer, length and gauge, points used, how the treatment was determined, depth of insertion, style of needling, length of time needles were retained, etc.

Example: Six acupuncture needles, Seirin Corp., Shizuoka, Japan, No. 3(0.20) x 30 mm were inserted bilaterally into acupoints San Yin Jiao (SP6), Zusanli (ST36), and Tai Xi (KI3) at a depth of 1.5cm and gently rotated until *daqi* was observed. Needles were retained for 20 minutes. Acupoints were chosen through consensus by a group of 4 TCM experts, each with over 20 years of TCM practice.

When describing an herbal formula, include the formula name if it is a patent herb formula. Also include the brand, manufacturer, dose, and each individual herb included in the formula. Some writers choose to list the indications for the herbal formula or each herb or acupoint although it is not necessary.

If a writer chooses to list indications, it should not be listed in the materials and methods section. Indications should be reserved for the introduction or discussion section. Remember, the materials and methods section is a description of exactly what was done and how it was done so another researcher can duplicate the protocol exactly.

Example: Traditionals, Zizyphus Sleep Formula, *Suan Zao Ren Tang* distributed by Kan Herb Company, Scotts Valley, CA. Lot 0610-07 was used in this study. The dose

given to the subjects was: 2 tablets, 3 times a day for 5 days on an empty stomach (1 hour before/2 hours after eating). Herbs include: Sour jujube seed (dry fried) (*Suan Zao Ren (chao)*), Sichuan lovage rhizome (*Chuan xiong*), Poria (*Fu ling*), Anemarrhena rhizome (*Zhi mu*), Chinese Licorice root (*Gan cao*).

When preparing to write a scientific paper, refer to these guidelines but before you begin, PLEASE search for more information online. There are so many fantastic resources for people writing scientific papers. Many of these resources are on the websites of major research institutions and universities.

Here are a few:

How to Write the Methods Section of a Research Paper by Richard H Kallet, MSc, RRT, FAARC

http://cancer.dartmouth.edu/documents/pdf/methods_section.pdf

Scientific Writing Booklet

<http://cbc.arizona.edu/sites/default/files/marc/Sci-Writing.pdf>

<http://abacus.bates.edu/~ganderso/biology/resources/writing/HTWsections.html#methodsstructure>

The Discussion Section

I would like to further examine the discussion/conclusion section. There are many websites that offer support for scientific writing, including format and templates. Many colleges and universities have detailed instructions published online. A recent Google search shows this simple straightforward list from the University of South Carolina website:

<http://www.usca.edu/biogeo/researchguide/writing.html>

If you can answer "Yes" to the following questions you have written a good discussion section:

1. Did you reach conclusions about the initial hypotheses?
2. Did you compare conclusions to those of others?
3. Did you identify sources of error and basic inadequacies of technique?
4. Did you speculate upon broader meanings of the conclusions reached?

5. Did you identify further steps needed in research on the problem?
6. Did you suggest improvements of methods?

I've noticed that many of our AOM authors neglect a few of these listed above that are necessary in the discussion: sources of error and basic inadequacies of the technique, improvements of the methods, and further steps needed in research in the problem.

If we are doing research and reporting our data, we are scientists. Before we write our discussion section we must get into the humble mindset of the scientist. In the world of science there is no such thing as a proven fact; instead, there are theories. As scientists we collect data, we report our data, and we formulate a possible conclusion based on the data we've collected. Science is constantly growing, changing, taking new shape, and evolving. Theories we believed to be true 50 years ago may not be true today. As we discover new things and new ways to examine things, we find out that in many cases we were previously wrong. That's OK—that's science.

Our wording should reflect this humility. For example, we should never claim that our data PROVES anything...instead we should claim that "this data supports the use of..." or "the data collected in this survey might support the theory that...." When writing our discussion and conclusion in our scientific papers we must always remember that we might be wrong. We should search for flaws in our methods and criticize ourselves. We should examine areas where we could have been more rigorous and explain how we might improve in the future. Most importantly, at the end of our discussion section, it is necessary to conclude with a statement that "...further research should be done to help support this conclusion."

Active versus Passive Voice

Active versus passive voice in scientific writing style has spurred much debate in the last ten to fifteen years. Passive voice was the standard, having been taught in all major universities from the early 1920s to the late 1900s. Much to the dismay of their senior faculty, in the early 2000s some of the more progressive educators and authors began to challenge this norm by writing and teaching new authors and investigators to take a more personal "active" voice when writing their lab reports and research manuscripts. Today the active writing style is seen more often in the literature and has become accepted and sometimes preferred by most editors and peer reviewers of scientific journals.

What Is Active Voice?

The active voice emphasizes the performer (or agent) of the action: The active voice is direct (performer–verb–receiver). Example: *We have analyzed the results.*

What Is Passive Voice?

The passive voice emphasizes the receiver (or product) of the action: The passive voice is indirect (receiver–verb–performer). Example: *The results have been analyzed.*

Simon R. Leather presents an argument for the use of passive voice in an editorial in *Nature* (1996June; 381:467): “Using the passive voice in scientific writing allows the researcher to stand at a distance from his or her work. By standing at a distance, an unbiased viewpoint is much more likely to be reached. An unbiased viewpoint encourages a world view and an open mind, surely prerequisites for good science...The use of the passive voice encourages disciplined writing, cases must agree, tenses must be used correctly. It is therefore more demanding, but the precision and professionalism displayed is worth the effort.”

I was trained by the ultra-conservative faculty at the Indiana University School of Medicine to always use a passive voice in scientific writing. In exploring modern trends for this discussion, I found an interesting fact. The first use of the active voice was published in 1953 by James Watson, another student of Indiana University. When Watson and Crick made their groundbreaking discovery, they chose a more powerful active voice to present it to the world: “We wish to suggest a structure for the salt of deoxyribose nucleic acid (D.N.A.).” (Watson JD, Crick FHC. Molecular structure of nucleic acids. *Nature*. 1953;171:737-738.)

Which style is correct? Neither or both—it’s a personal choice. If you are writing for a journal, look at its author guidelines to see if one or the other is preferred. Some topics call for more active style. If you choose an active writing style and you’re writing a report on original research, it’s best to use the passive style in your methods section. When using the passive voice, take care that your sentences are clear, concise, and not awkward. If in doubt, do your own research about the use of active versus passive style.