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The Abstract and the Elevator Talk: A Tale of Two Summaries

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What is an elevator talk, and what does it have to do with writing a paper? A lot. Imagine you are the president of the nonprofit Light Is The Solution Foundation. The board of directors is meeting at the New York Hilton, and you are waiting to ride the elevator from the 31st floor to the lobby. The doors open, and you suddenly find yourself standing with Bill Gates, whose philanthropic Gates' Foundation is meeting at the same hotel. Gates notices the logo on your shirt of a small child reading a book by the light of a lantern and asks you, "What is that? What do you do?"

Indeed, what do you do now? You have 30 floors, or about 1 minute, to get your message across. So you explain that normal living activities cease in many countries in the world after the sun goes down. Children have no light to read textbooks, mothers no light to cook, fathers no light to earn income. With this background, you then explain that the Light Is The Solution Foundation has addressed this problem by developing rechargeable lanterns that are low-cost, have a battery life of 30 hours, and put out light equivalent to three 60-W bulbs. You have given away 4500 lanterns in one country and have results showing that more children now share books, study together, and graduate at a higher rate. In fact, average incomes have risen by 20% for families who have received a lantern. You have concluded that this unique program could be expanded to any country that has even the crudest electrical grid or generators for recharging the lanterns.

This is the elevator talk. Your 1-minute opportunity to summarize what you do, how you do it, the results you produce, and the impact you make. A well-developed elevator talk entices the listener to want to learn more. In many professions, entire careers are made and lost as a result of elevator talks.

The elevator talk and the abstract of a scientific paper have a lot in common. Although written rather than spoken, the abstract also provides a summary of the important information an author wants to convey to the reader, with the goal of enticing the reader to want to learn more. Instead of a limitation on the amount of time, the author has a limitation on the number of words. The challenge is to make the most effective use of these words. Here I provide you with some basic information about the abstract and highlight the characteristics of a well-written abstract (Table 1).

Tell a Story by Answering Questions

An abstract is a summary or, more precisely, a condensed version of your paper. Its purpose is to tell the reader not just the basic information or data contained in the paper but also why the paper was written and what value it adds. For example, imagine you were writing a review article on pharmacogenomics. You would not immediately jump into descriptions of the current literature without first telling the reader why pharmacogenomics may be important to them. You want to provide the reader with some brief background of why the field exists to begin with. Nor would you simply stop the review without telling the reader where you believe this field of medicine is headed and what may lie ahead.

For papers of original research, the IMRAD format (Introduction, Methods, Results, and Discussion) is

Table 1. Characteristics of a well-written abstract.

Stands on its own without need to read the paper
States the hypothesis, question, or objective of the study
Completes the story by answering the hypothesis, question, or objective
Contains the same key words and terms as the title and the introduction
Follows the correct style and format
Follows the order of the main text (e.g., IMRAD)
Stays within the allowed word count
Does not contain information absent in the paper
Does not make conclusions unsupported by the data
Limits the use of abbreviations
Does not include references
Does not cite tables or figures

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commonly followed. Although different from the format of a review, each section contributes to the overall story by answering one or more questions:

Introduction—What problem, question, or hypothesis is being studied? Why would it be of interest to the reader?

Methods—How did you perform the study, test the hypothesis, or answer the question?

Results—What did you find? Did you solve the problem, prove the hypothesis, or answer the question?

Discussion—What do your results mean? What value do they add to the scientific literature?

A well-written paper tells a story, even if in scientific language, by answering important questions. A well-written abstract should tell the same story by answering the same questions. It should start with 1 to 2 sentences introducing the topic and the goal of the study and end with 1 to 2 sentences telling the reader what your results mean. In between are the most important answers for the reader, which are how you performed the study and what you found. Thus, the majority of the abstract should cover the methods used and the results obtained.

Use the Correct Style and Format

Abstracts can be written in 2 formats (simple/conventional and structured) and 2 styles (descriptive and informative). A simple abstract consists of a single narrative paragraph that may follow the IMRAD format without specifically associating the text or information with any of the IMRAD headers listed above; they can be descriptive or informative. Examples of journals that use the simple format are *Analytical Chemistry* and *The American Journal of Pathology*.

In a structured abstract, the text is divided under individual headings, almost like a miniversion of the paper. The author provides specific information under each heading. *Clinical Chemistry* requires structured abstracts with 4 headings: Background, Methods, Results, and Conclusions. *JAMA* uses a different set of headings: Context, Objective, Design, Setting, Patients/Participants, Main Outcome Measures, Results, and Conclusions.

Descriptive abstracts, as the name implies, describe the content of the paper, much like a summary paragraph found at the end of the paper. A descriptive abstract answers the questions discussed earlier but does so in general terms. It does not provide details about the design of the experiments or the resulting data and is often shorter in length (75–150 words). The descriptive abstract is appropriate for articles such as reviews that do not contain original research data; however, some high-visibility journals such as *Nature* and *Science* have lower word limits and publish descriptive abstracts for research papers as well.

Informative abstracts include actual details of the research study, such as study design, methods used, important results, and conclusions. An informative abstract includes enough material to serve as a surrogate for the full paper. Because most research studies follow detailed protocols, use sophisticated methodologies, and generate a substantial amount of data, the informative abstract is common in scientific publications.

Nearly every journal's information/instructions for authors state what type of abstract is required, so ignorance is no excuse for preparing an abstract improperly.

Create an Abstract That Stands on Its Own

After the title, the abstract is the second most commonly read part of a paper. Like the title, the abstract must stand on its own. In the age of electronic publishing, fewer papers are being accessed by flipping through the pages of a printed copy of a journal. Internet sites such as PubMed display just the title and abstract for a published paper. Similarly, many journal Web sites allow nonsubscribers to see only the abstract for a published paper, with a pay-per-view option for access to the entire paper. Thus, the abstract must stand on its own. If readers are not impressed by the information in the abstract or perceive the study to be weak because the abstract is weak, they will simply move on to another paper. Similarly, editors and peer reviewers also form an initial opinion about a submitted paper from what they see in an abstract.

Regardless of the style or format, any abstract fails to achieve its goal if it lacks sufficient useful information. Authors sometimes assume that because no abstract can describe all of the information in a paper, individuals will take the time to read the full paper to find material missing from the abstract. Readers want as much detail as you can provide, given the word limit set by the journal. They also want to understand the rationale behind the study and what conclusions can be drawn from the results.

Write the Abstract after Completing the Main Text

Some authors find that drafting the abstract early in the process helps encapsulate the major points being considered for the paper. Since the abstract is a condensed version of the full paper, however, a logical time to write it is after the rest of the paper is complete. An abstract written too early in the process may end up containing information, data, or statements not found in the main text (or the reverse). I recall double-checking results in a table, finding that they needed

modification, and almost forgetting to make the same modification in the abstract.

Reviewers and editors often request the addition or deletion of text, more information about experiments, reanalysis of data, reinterpretation of results, modification of conclusions, and so forth. Thus, it is important to reevaluate the content of the abstract when you revise a manuscript to ensure that the abstract coincides with the revised text.

Another reason for writing the abstract after completing the main text is that it allows you to link the abstract to the title and the introduction, which is a subtle yet important aspect of a good paper. The main message about the study conveyed through the title should be conveyed again to the reader in the abstract. Similarly, the background information contained in the abstract should parallel the background information in the introduction. You can borrow sentences from the introduction and include them in the abstract. Use of the same nouns, verbs, or adjectives in the title, abstract, and introduction is not only perfectly acceptable but also potentially beneficial, because it allows you to use the key terms for inclusion in indexing services (e.g., PubMed) and search engines (e.g., Google) multiple times.

Avoid Abbreviations

One fairly common error authors make is to use abbreviations in the abstract and assume that the reader will refer to a separate list of abbreviations or the main text. Remember that journal Web sites, as well as PubMed, typically provide access to the abstract and not to the main paper. A few abbreviations are more widely used than the spelled-out names (e.g., DNA, RNA, AIDS) and can be used without confusing readers. If a disease with a long name, such as amyotrophic lateral sclerosis (ALS), is the focus of the paper and is mentioned multiple times in the abstract, the abbreviated form may be used after being defined the first time it is used in the abstract. Otherwise, try to avoid using abbreviations.

Learning Exercise

Below I have drafted an abstract for a hypothetical study. With the information presented in this guide, try to identify any weaknesses in the abstract and what suggestions you have for improvements. Then see if the revised version provided in the box after the list of selected additional reading materials corrects any of the problems you identified. The abstracts contain 205 and 203 words respectively.

BACKGROUND: Atherosclerotic disease is a major cause of death in the United States. We investigated which analyte, IL-6 or β-selectin, would be a better prognostic marker for atherosclerotic disease.

METHODS: We divided patients into 4 groups. Specimens from each patient were tested for interleukin-6 and β-selectin and matched against the patient's disease group. During the study period, these analytes were measured again to determine whether concentrations changed with disease severity. Mortality was also monitored for each group to investigate any relationship between IL-6 or β-selectin and the risk of death.

RESULTS: The IL-6 concentrations were different between groups, with the IL-6 concentrations significantly different between groups 1 and 3, and 1 and 4. Although IL-6 and β-selectin concentrations both changed, β-selectin changed by only 10% to 30%. Changes in disease severity were reflected in changes in IL-6. IL-6 values were the same for men and women and did not show any relationship with patient age. Intraindividual variation for IL-6 was much lower than that for β-selectin.

CONCLUSIONS: IL-6 and β-selectin concentrations change with a change in heart disease severity. Intraindividual variation of IL-6 was also much lower than β-selectin, further validating the use of IL-6 over β-selectin. Further work is needed to confirm this observation.

Final Thoughts

Former US President Woodrow Wilson once said, "If I am to speak ten minutes, I need a week for preparation; if fifteen minutes, three days; if half an hour, two days; if an hour, I am ready now." If he were writing a scientific paper, I predict he would have had the same thoughts about developing an abstract. Entire pages of information can be written in a short time; the process of condensing that information with well-chosen words takes much more time. But a good abstract is worth it.

Additional Reading

Katz MJ. From research to manuscript. New York: Springer; 2009.
Matthews JR, Matthews RW. Successful scientific writing. New York: Cambridge University Press; 2008.
Zeiger M. Essentials of writing biomedical research papers. New York: McGraw Hill; 2000.

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quirements: (a) significant contributions to the conception and design, acquisition of data, or analysis and interpretation of data; (b) drafting or revising the article for intellectual content; and (c) final approval of the published article.

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Answer to Learning Exercise

BACKGROUND: Serum concentrations of the vascular inflammation marker β-selectin correlate with atherosclerotic disease severity, but β-selectin has a large intraindividual variation. We investigated whether interleukin-6 (IL-6), another marker of vascular inflammation, could predict disease severity and mortality risk.

METHODS: Consecutive outpatients undergoing evaluation for peripheral vascular disease (PVD) were divided into categories ranging from no functional impairment (group 1) to severe functional impairment (group 4). Blood was collected at baseline and quarterly over 3 years. Serum IL-6 and β-selectin were quantified to calculate intraindividual variation and to assess the relationships of these markers to disease severity and mortality.

RESULTS: Baseline median IL-6 concentrations were 12, 26, 96, and 144 μg/L for categories 1 to 4, respectively ($P < 0.001$ for categories 3 and 4 vs 1) and were not found related to age or sex. Median β-selectin concentrations increased 30% across the 4 categories. Increased disease severity and mortality were associated with higher IL-6 concentrations ($P < 0.01$ for both), but not β-selectin. Intraindividual variation for group 1 was 14% for IL-6 and 36% for β-selectin.

CONCLUSIONS: IL-6 appears to be a better marker of disease severity and mortality than β-selectin in patients with PVD, with lower intraindividual variation and significant concentration changes with increasing disease severity.