Writing Effective Manuscripts for 21st Century Readers

Tips for Scientific Writing

Thomas Annesley

Why a need for a guide to scientific writing? Why write differently than in the past?

Because the publishing environment has changed

- The 21st century reader is different
- The 21st century peer reviewer is different
- The 21st century journal is different

What do authors and readers want? It isn't the same thing.

- **Author behaviour**
  - Want to publish more
  - Peer review essential
  - Other journal functions crucial
  - Wider dissemination
- **Reader behaviour**
  - Want integrated system
  - Browsing is crucial
  - Quality information important
  - Want to read less

Elsevier study of 36,000 authors presented by Michael Mabe at ALPSP Seminar on "Learning from users"; www.alpsp.org

It is incumbent on the author to:

Make the reader's job simple

Make the peer reviewer's job simple

Make the editor's job simple

There is no form of prose more difficult to understand and more tedious to read than the average scientific paper.

Francis Crick, The Astonishing Hypothesis, 1994

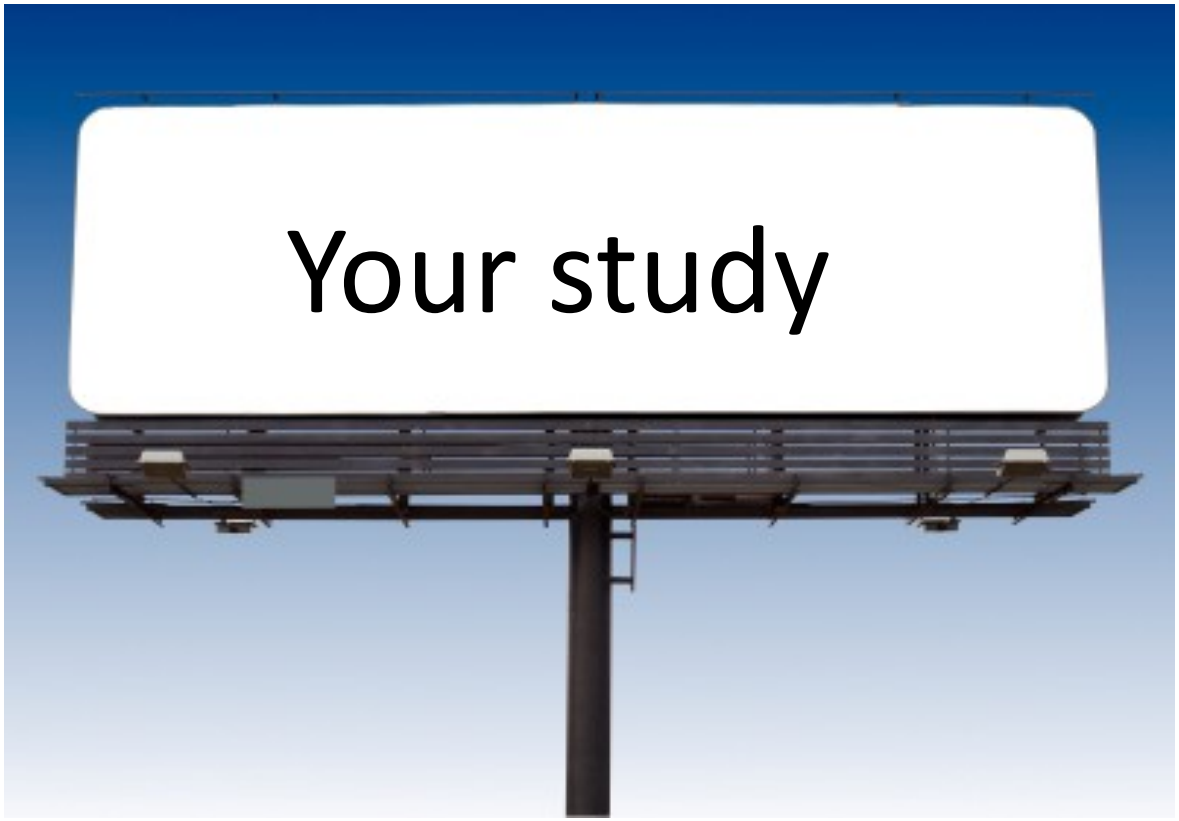
Being Clear, Concise, Consistent, Comprehensive

Begins with the title

Carries throughout the entire manuscript

The Title

Title (The Billboard)



The title should use necessary words:

(avoid wasted words)

"a study of," "investigation of," "development of," or "observations on"

"new," "improved," "novel," "validated," and "sensitive"

Readers understand that you would not be writing the paper unless you had studied, investigated, developed, or observed something.

Why would a journal want to consider a study that was not new, not validated, or not sensitive?

“Development and evaluation of a new assay for the sensitive detection of ….

12 words and we still do not know the main topic of the manuscript!

Who is your audience?
What do you want to Google to display?

Emphasize (ideally begin) the title with the important term

Amniotic fluid sphingomyelin quantification is useful for identifying G1-α gene mutations of unclear significance
Obstetrician

G1-α gene mutations of unclear significance can be identified by amniotic fluid sphingomyelin quantification
Geneticist

First Trimester Pregnancy-Associated Plasma Protein A is Influenced by Smoking

Obstetrician

Smoking Influences First Trimester Pregnancy-Associated Plasma Protein A

Epidemiologist

The Abstract

The Abstract (The Elevator Talk)

allmoviephoto.com

Abstract (The Elevator Talk)

Make or break decision point for editors

First impression for reviewers

Affects the citation rate for a paper

Rationale for the study

Study design and methods used

Results

Conclusions supported by the data

Abstract - Common Problems

Background fails the logic test

Methods lack sufficient detail

Results are too general

Conclusions restate the results

Background (1): Serum concentrations of the vascular inflammation marker β-selectin correlate with atherosclerotic disease severity. We investigated whether interleukin-6 could predict disease severity and mortality.

Comments?

Background (2): Serum concentrations of the vascular inflammation marker β-selectin correlate with atherosclerotic disease severity, but β-selectin has a large intra-individual variation. We investigated whether interleukin-6, another marker of vascular inflammation, could predict disease severity and mortality.

Methods (1): Outpatients undergoing evaluation for peripheral vascular disease were divided into categories of functional impairment. Interleukin-6 and β-selectin were quantified to calculate intra-individual variation and to assess the relationships of these markers to disease severity and mortality.

Comments?

Methods (2): Consecutive outpatients undergoing evaluation for peripheral vascular disease were divided into categories ranging from no functional impairment (group 1) to severe functional impairment (group 4). Serum interleukin-6 and β-selectin were quantified at baseline and quarterly over 3 years to calculate intra-individual variation and to assess the relationships of these markers to disease severity and mortality.

Results (1): Baseline interleukin-6 and β-selectin concentrations changed across the categories, but the change in interleukin-6 was larger. Increased disease severity and mortality were associated with higher interleukin-6 concentrations, but not β-selectin. Intra-individual variation for group 1 was lower for interleukin-6 than for β-selectin.

Comments?

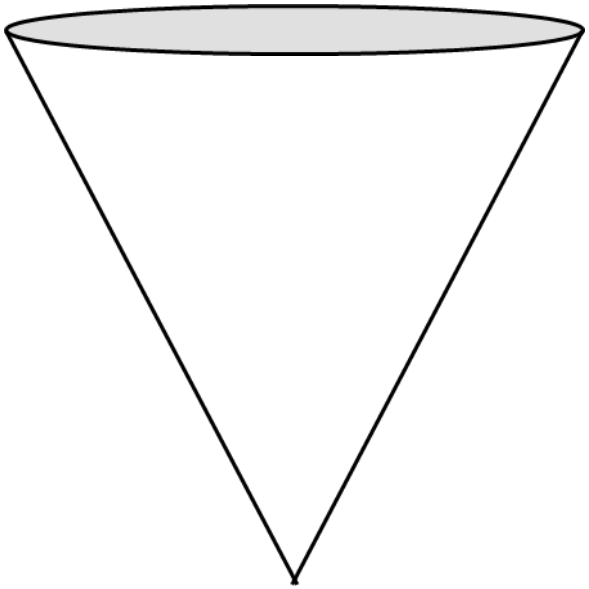
Results (2): Baseline median interleukin-6 concentrations increased 1200% across the 4 categories ($P<0.001$ for categories 3 and 4 vs. 1), while median β-selectin concentrations only increased 30%. Increased disease severity and mortality were associated with higher interleukin-6 concentrations ($P<0.001$ for both), but not β-selectin. Intra-individual variation for group 1 was 14% for interleukin-6 and 36% for β-selectin.

Conclusions (1): Interleukin-6 concentrations increased 1200% while β-selectin increased 30%. Intra-individual variation for interleukin-6 was 14% vs. 36% for β-selectin.

Comments?

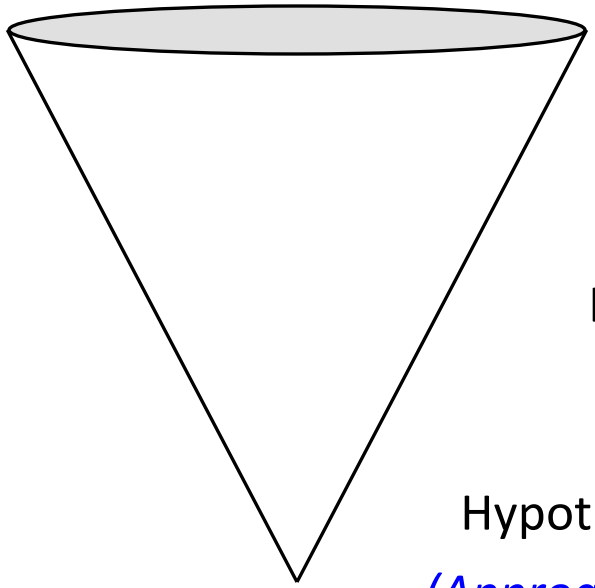
Conclusions (2): In our population interleukin-6 was a better marker of disease severity and mortality than β-selectin in patients with peripheral vascular disease, exhibiting lower intra-individual variation and significant concentration changes with increasing disease severity.

The Introduction



Cone or Funnel

Introduction flows from broad to narrow (cone or funnel)



Background, known information

Knowledge gap, unknown information

Hypothesis, question, purpose statement

(Approach, plan of attack, proposed solution)

Correct way to write an introduction

Keep the cone/funnel in mind and think of the introduction as 4 sentences:

1. The general topic or situation (broad “known”)
2. The specific topic or situation (project-related “known”)
3. The gap in our knowledge of the specific topic or situation (“unknown”)
4. What you did to fill the gap

The 4-question introduction

General: What is the topic of my research?
IV drug users who share needles have a high incidence of viral infections

Specific: What aspect was I interested in?
Lack of clean needles exacerbates the problem

Gap: What is missing? What is the gap?
Few studies of free needle distribution

Goal: What was my question, hypothesis, goal?
Could a controlled trial of a needle distribution and medical follow-up using serological tests help?

Methods/Experimental

Increases in the “sins of omission”

Becoming more common:

- Medical journals
- Split studies
- Studies involving in-house developed tests
- Proprietary tests

It is critical that authors report:

For commercial diagnostic tests, the actual name and generation of assay, the manufacturer, and the instrument used for analyses.

Performance characteristics, such as the imprecision of the assay in the investigators' laboratories, the assay's reportable range, and any reference (normal) range used in the study.

The types of specimens analyzed and the storage conditions for these specimens (BRISQ guidelines).

Results Section

The Results Section

Data and results are not the same!

Authors can err by offering the reader results but no data, or data but no results.

Data are facts and numbers

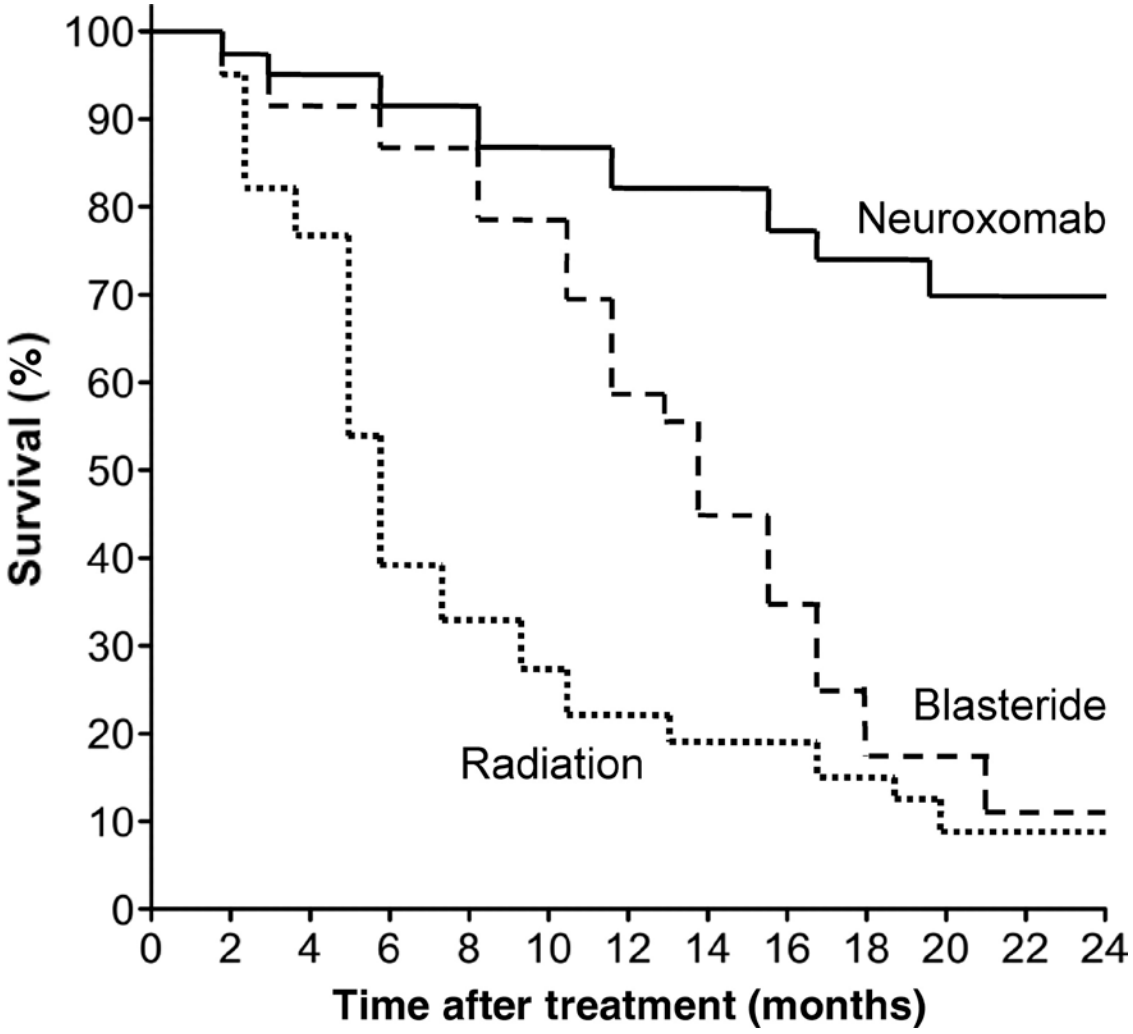
> Usually presented in tables and figures as raw data (individual data points) or summarized data (mean, percent, median and range).

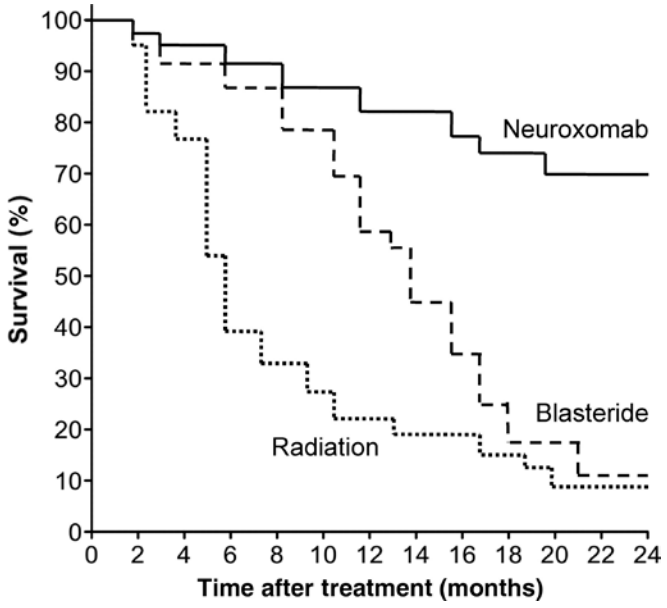
Results are statements in the main text that summarize or explain what the data show.

Data presented in figures and tables must have a corresponding result in the main text.

Results in the main text must have a corresponding piece of data in a figure or table.

Figure 1. Two-year survival rates for patients with neuroblastoma treated with Neuroxomab, Blasteride, and radiation



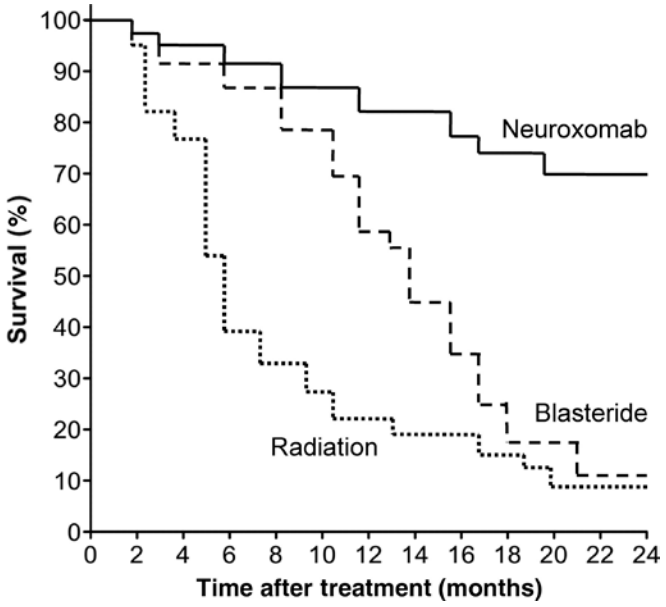


In the text:

"Six months after diagnosis and initiation of treatment, the survival rates were 95% for the Neuroxomab group, 91% for the Blasteride group, and 39% for the radiation-treated group (Fig. 1). At 12 months the rates were 83%, 69%, and 23%; at 18 months 74%, 17%, and 15%; and at 24 months 70%, 11%, and 9%."

This paragraph provides data but no results:

What do the data show?
What is the point?
Are the treatment groups different at 6 months?



In the text:

"Six months after diagnosis and initiation of treatment, the survival rates for the Neuroxomab and Blasteride groups were 2.4 and 2.3 times higher, respectively, than the radiation treatment group (both $P < 0.001$), but survival rates did not differ between the Neuroxomab and Blasteride groups ($P = 0.56$) (Fig. 1). By 12 months, however, patient survival in the Neuroxomab group was 1.2 times higher than in the Blasteride group ($P = 0.031$), and 4.3 and 6.4 times higher at 18 and 24 months (both $P < 0.001$)."

This paragraph explains what the data show (informative results):

The magnitude (e.g., 2.4 times higher) of most important differences
When the differences occurred
Whether they were statistically significant

The Results Section

Make sure that your Results section is consistent with other sections!

Is there a result that does not have a corresponding method or experiment in the Methods section?

Is there a method or experiment for which you have reported no results?

Is there a result not covered in the Discussion section, or discussion of a result not contained in the Results section?

Are the most important results the same as those highlighted in the Abstract?

Do the results relate to the study question, hypothesis, or problem first presented in the Introduction?

Discussion

The Discussion Section

Your closing argument

NBC Corp., Law and Order TV Series

Discussion: Create a framework by answering these questions

- What exactly did the study show?
- What might that mean?
- How else could the results be interpreted?
- Have other studies had similar results, or is there disagreement in the field?
- What are the study's strengths and weaknesses?
- What, exactly, should happen next?

Template for the Discussion

A "story" that consists of the following:

- Beginning:
  - The answer to the study questions
    (and the key evidence that supports the answer)
- Middle:
  - Explaining/defending the answer
  - Explaining conflicting results
  - Secondary findings
  - Limitations
- End:
  - Conclusion and implications

Discussion: End

Conclusion/Summary
Come to a definite and strong end:

1. Restate the answer to the question.

2. Signal the end by using a phrase such as *"In conclusion"*, or *"In summary "*, so readers will know this is the answer.

3. Then indicate the importance of the work by briefly stating applications, recommendations, implications, or speculations.

In conclusion, our study shows that 4-methylpyrazole blocks ethylene glycol metabolism mediated by alcohol dehydrogenase. **Our study further supports** the addition of this competitive inhibitor to the existing repertoire of agents that can add to the effectiveness of dialysis for the treatment of solvent ingestion. **The fact that** none of the patients who received 4-methylpyrazole showed any allergic side effects supports the safety of this compound in emergency situations.

Discussion

Additional tips

- **Avoid "More research is needed…"**
  - Unless you say very specifically what is needed

Example:

A larger multicenter study should be conducted to confirm these results and to address many issues, including the best dose of growth hormone and the length and frequency of therapy that are necessary to produce and maintain clinical remission.

Preparing a Manuscript

- Figures & Tables
- Materials and Methods
- Results
- Introduction
- Discussion
- Abstract (only when manuscript is completed)

Summary

Why you need to write differently than in the past

The importance of an effective Title

Common problems with Abstracts

Use of a funnel/cone to organize the Introduction

Data and results are not the same

Discussion is like the closing argument in a courtroom

Clinical Chemistry

looking for something?

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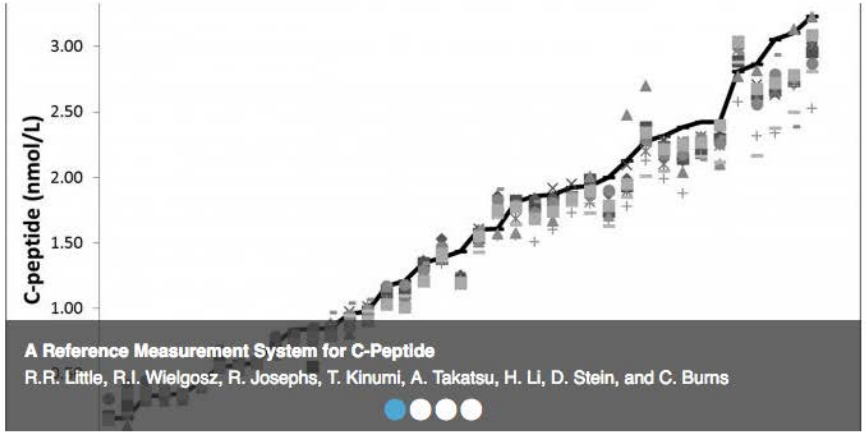
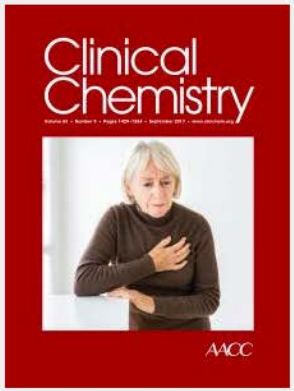


A Reference Measurement System for C-Peptide
R.R. Little, R.I. Wielgosz, R. Josephs, T. Kinumi, A. Takatsu, H. Li, D. Stein, and C. Burns

Current Issue : September 2017



Audio Summary of this issue

RESOURCES

New! AACC Learning Lab
Clinical Chemistry Trainee Council
Clinical Case Studies
Guide to Scientific Writing

Podcasts
Journal Club
Q&A

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Harmonization: Its Time Has Come

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Guest: Daniel Korevaar
Facilitating Prospective Registration of Diagnostic Accuracy Studies: A STARD Initiative

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Available July 2014

16 Chapters
55 Learning Exercises