Successful Scientific Writing:

Step by Step

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### Abstract

**Purpose:** to highlight key points from major sections of the article

<table>
<thead>
<tr>
<th>Component</th>
<th>Abstracted from</th>
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<td>Major purpose of study</td>
<td>Introduction</td>
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<td>Basic procedures</td>
<td>Methods</td>
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<td>Main findings</td>
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<td>Principal conclusions</td>
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**Emphasize what is new and useful.**

### Introduction

**Purpose:** to convince the reader that your study will yield knowledge or knowhow that is new and useful

- Identify a gap in knowledge or knowhow (Study problem).
  - Provide key background (scope/nature/magnitude of the gap).
  - Be clear that filling this gap will be useful.
  - Describe the relevant limitations of previous studies.
- Present your approach to filling the gap (Study purpose).
  - Be clear that your approach is new.
  - Emphasize that your approach addresses the limitations of previous studies in a logical/compelling way.

**Often requires just three paragraphs**

### Methods

**Purpose:** to describe how you collected, organized and analyzed data (relevant to the study purpose)

- Clearly present/define all analysis variables.
- Organize into logical subsections that illustrate the steps you took to collect, organize and analyze the data, e.g.,
  - Study population
  - Definition of variables
  - Laboratory methods/epidemiologic investigation
  - Intervention
  - Statistical analysis
- Describe what you did, not what you found (Results)
- Respect chronology
- Describe original methods in detail; otherwise give references.

**Length varies depending on originality of methods**

### Results

**Purpose:** to describe the results of data analysis that are relevant to the study purpose

- Start with tables and figures. Write the text later.
  - Use tables to highlight individual values.
  - Use figures to highlight trends and relationships.
- Text supplements/reinforces tables and figures.
  - Summarize/emphasize highlights.
  - Fill in gaps (often minor).
- Present results in a logical sequence.
- Describe what you found, not what you did (Methods).
- Consider subsections similar to the ones in Methods.
- Look to published articles for potential templates.

**Tables/Figures**

- Check your math; provide consistent row or column summation.
- Keep lines to a minimum; avoid vertical lines.
- Use footnotes to clarify points of potential ambiguity.
- Check headings, labels of rows/columns/axes, and footnotes

**Text**

- Highlight key relationships between dependent/independent variables.
- Present a logical sequence:
  - in parallel with methods (consider similar subheadings)
  - background data → descriptive → bivariate → multivariate
- Make sure all numbers in text are consistent with tables/figures.

**Often requires just three paragraphs + three tables/figures**

### Discussion

**Purpose:** to interpret your results and justify your interpretation

- Distill the essence of your study.
  - Restate key results.
  - State main conclusion.
    - Be clear about why results support the conclusion.
    - Maintain connection with purpose of the study.
- Interpret your study in the context of the literature.
  - Compare with results of/methods used in related studies.
  - Emphasize strengths of your study, and what is new.
- State limitations/caveats (frankly, without apology).
- Make recommendations
  - changes in practice/policy
  - future studies, including some specifics (e.g. study method)

**Often requires just four or five paragraphs**

### Title

**Purpose:** to provide a brief, informative summary that will attract your target audience

**What goes into the title?**

- **The Topic (T)** – study subjects and setting
  - "who, what, when, where"
- **In addition, choose one or two among:**
  - M – Methods
  - R – Results
  - C – Conclusions
  - N – Name of study or data set

**Highlight what is new and useful**

**TITLE**

| Longitudinal evaluation of prostate-specific antigen levels in men with and without prostate disease | + | + |
| An injury prevention program in an African-American community | + |
| Smoking, pregnancy, and source of prenatal care: Results from the Pregnancy Risk Assessment Monitoring System | + | + |
| Reduction of high-risk sexual behavior among heterosexuals undergoing HIV antibody testing: A randomized clinical trial | + | + | ? |
Writing the article and submitting it to a journal

- Conduct literature review
- Start the paper!
- Conduct study/analyze data
- Organize/summarize results succinctly
- Get early, frequent feedback (in "chunks")
- Formulate your key message
- Apply the "new/useful" test
- Choose your target audience
- Choose your target journal
- Read journal instructions for authors
- Draft (and debug) an abstract
- Write the first draft
- Master the literature
- Relearn, rethink, rewrite
- . . . and rewrite and rewrite
- How long?
- Critically review and finalize the abstract
- Attend to the details
- Submit article to target journal
- Have a Plan B

Conduct literature review
- PubMed – try "Single Citation Matcher"
- Web of Knowledge
- NIH funded research (RePORTER)
- Contact leading investigators to learn about in-press or unpublished work.

Start the paper! (yes, even before you do the study)
- Draft the Introduction – perhaps borrow from a study protocol or grant proposal that you already wrote.
- Draft dummy table shells and figure axes for Results.

Conduct study/analyze data
Organize/summarize results succinctly
- Fill in dummy tables and figures with real data.
- Draft additional tables and figures if needed – look at published articles for potential templates.
- Summarize each table/figure in a single sentence.

Get early, frequent feedback (in “chunks”)
- Ask coauthors/colleagues if your tables/figures and text summaries are clear/concise/compelling.
- Give presentations to colleagues and at conferences.
- The more hurdles you clear before you submit your paper to a journal, the fewer you will be asked to clear during the review process.
- Don’t wait for a complete draft to begin getting feedback.

Formulate your key message
- Keep it simple; try to boil down to a single sentence.
- Your message must contain something new and useful.
- Make sure your results support your key message.
- The message may change as you develop the paper.

Apply the “new/useful” test
- Journal editors are interested in new information that is useful to their target audience. Does your study meet these criteria? If not, the effort of writing a manuscript may not be warranted. If yes, . . .

Choose your target audience
- What audience is most interested in your message?
  - clinicians?
  - public health practitioners?
  - basic scientists?
  - a broad audience?

Choose your target journal
- Select based on
  - match with target audience
  - strength of your article
- Consider aiming high; reviewer comments from a high-level journal can be valuable.
- But aiming high with data that are getting “stale” is risky.

Read journal instructions for authors
- Find target journal instructions for authors on the Internet.
- Is your key message relevant to the target journal’s mission statement?

Draft (and debug) an abstract
- Check for internal consistency:
  - logical flow from Purpose to Methods to Results to Conclusion?
  - Conclusion consistent with the Purpose?
- If you see flaws in the abstract, ask yourself: Do I need to do additional analysis? additional literature review? additional thinking?

Write the first draft
- Write for your target audience (use appropriate terminology or jargon).
- Consider using an outline.
- Don’t sweat the grammar, syntax or details (only you need to understand the first draft).

Master the literature
- As you master the literature, you will see your work in new light; transmit this new thinking to your manuscript.

Relearn, rethink, rewrite
- As you master the literature, you will see your work in new light; transmit this new thinking to your manuscript.

. . . and rewrite and rewrite
- “There is no such thing as good writing, only good re-writing.”
- “That which is written with little effort is, in general, read with little interest.”
- “It takes a long time to write a short story.”
- Most papers require at least five drafts, maybe ten; save and date them all.
- You may need to revise your key message.
- Perhaps consider changing target audience; target journal.
- Perhaps your paper is now better than you ever imagined, and you want to aim for a higher-circulation journal.

How long?
- Follow guidance in target journal’s instructions for authors.
- “Shorter papers get luckier faster.”

Critically review and finalize the abstract
- Check again for internal consistency (see above).
- Make sure the abstract is fully consistent with the body of the article.

Attend to the details
- Carefully review and comply with target journal’s instructions for authors.
- Call/e-mail the journal if you still have questions.

Submit article to target journal
Have a Plan B
- Decide on your next target journal in case you receive a rejection.
When the journal responds

- Acknowledgment of receipt
- Internal review
- External review
- Comments from editors/referees
- Responding to the comments
- Writing the cover letter
- When to contact the editor

Acknowledgment of receipt
- Usually by email within minutes and with some indication of how long you'll have to wait for a decision (Mark your calendar!)

Internal review
- The journal may reject your paper without submitting it for external review. If so, go to Plan B (i.e. second target journal).
- Some possible reasons for in-house rejection:
  - Your topic is not appropriate for the journal's audience.
  - The journal recently published papers on similar topics.
  - You did not follow the journal's instructions for authors.
  - The article is poorly written.
- If your paper is selected for external review: Congratulations! you've made it past the first hurdle.
- The editor will probably indicate how long you'll have to wait for a decision (Mark your calendar!)

External review
- Typically, by two or three reviewers
- The review consists of a cover letter from the editor along with comments from the reviewers. Reviewers provide the editor with advice: the decision to publish or not rests with the editor.
- The editor may invite you to revise and resubmit the paper in keeping with the reviewers' comments.
- If the paper is rejected, go to Plan B (second target journal).

Comments from the editor and referees
- Some comments will be thoughtful and helpful; others naive, tangential, derisive, hostile, sarcastic or just plain wrong.
- For each comment decide whether you need to:
  - revise the text, tables, figures?
  - extend your literature review?
  - conduct additional data analysis?

Responding to the comments
- Wait a day or two (till your blood stops boiling) and reread comments.
- Discuss them carefully with coauthors and other trusted colleagues to identify substantive content that may improve the paper.
- Start working on the requests to revise the text; this is easier than tracking down additional references or performing additional analyses — but don’t rule out the possibility of additional data analysis or literature review.
- Be grateful for those comments that are truly helpful; incorporate them carefully into your revised manuscript.
- Don’t fret over comments that aren’t helpful.
- Submit your revised manuscript within the time frame that the editor requests. If you can’t, contact the journal.

Writing the cover letter
- Make it easy for the editor to refer back to the referees' comments; e.g., itemize your responses.
- Make it easy for the editor to identify revised passages in the revised manuscript, e.g., refer to page and paragraph number.
- Express your sincere gratitude to the editor for the valuable feedback.

When to contact the editor
- to confirm the status of your paper after an extended period without communication from the journal
- to discuss a possible appeal if you receive a review that you and your colleagues/coauthors consider unfair or incompetent
- Editors appreciate calls from authors who express legitimate concerns about the review process, not from irate authors of marginal papers.

After your article is accepted

- Request reprints? may not be worth the expense
- Prepare for media calls.
- Respond to letters to the editor.

This guide includes material from the Successful Scientific Writing course and syllabus that I developed in collaboration with Richard A. Goodman, MD, JD, MPH. I would like to thank Dr. Goodman for his input to the course and the syllabus. Additional thanks to Juan Carlos Zevallos, MD, for his thoughtful critique and careful editing.

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