Methods, Results, Tables and Graphs, and Abstracts

Overall Structure of a Paper: Like an Hourglass

Topics for Today

- The Methods Section
- The Results Section
- Tables and Graphs
- The Abstract

- Note: This session is intended to be practical and interactive.

The Methods Section

Purposes of the Methods Section

- To allow others to replicate what you did
  - In order to test it
  - In order to do further research
- To allow others to evaluate what you did
  - To determine whether the conclusions seem valid
  - To determine whether the findings seem applicable to other situations

Methods: Basic Information to Include

- In most cases, overview of study design
- Identification of (if applicable)
  - Equipment, organisms, reagents, etc used (and sources thereof)
  - Approval of human or animal research by an appropriate committee
  - Statistical methods

Methods (cont)

- In some journals, may include subheads
- May include tables and figures
- Should be written in past tense
- Helpful to use papers published in the same journal as models

Methods: An Issue—How Much Detail to Provide About

- Well-known methods
- Methods previously described but not well known
- Methods that you yourself devised

Exercise

- Look at the methods section of the article that you brought or that was provided.
- How is this methods section structured?
- What do you notice about the content?

The Results Section, Tables, and Figures

The Results Section

- The core of the paper
- Often includes tables, figures, or both
- Should summarize findings rather than providing data in great detail
- Should use past tense
- Should present results but not comment on them
- (Note: Some journals, however, combine the results section and the discussion.)

Results Sections of Papers with Tables or Figures

- How much should the information in the text overlap that in the tables and figures?
  - Not extensive overlap
  - In general, text should present only the main points from the tables and figures
  - Perhaps also include a few of the most important data
- Remember to mention each table or figure. Do so as soon as readers might want to see it.

Mentioning Tables and Figures: Some Writing Advice

- In citing tables and figures, emphasize the finding, not the table or figure.
  - *Not so good*: Table 3 shows that postdoctoral fellows who attended these sessions published twice as many papers per year.
  - *Better*: Postdoctoral fellows who attended these sessions published twice as many papers per year (Table 3).

Exercise: Results Sections

- Look at the results section of the journal article that you brought or that was provided. Notice items such as the following:
  - Length
  - Organization
  - Inclusion of subheads (or not)
  - Amount of detail
  - Number of tables and figures
- Be ready to discuss your observations.

Tables and Figures: Some Basics

Tables: A Few Suggestions

- Use tables only if text will not suffice.
- Design tables to be understandable without the text.
- Organize each table in a logical way.
- If a paper includes a series of tables, use the same format for each.
- Be sure to follow the instructions to authors.

Figures: A Few Suggestions

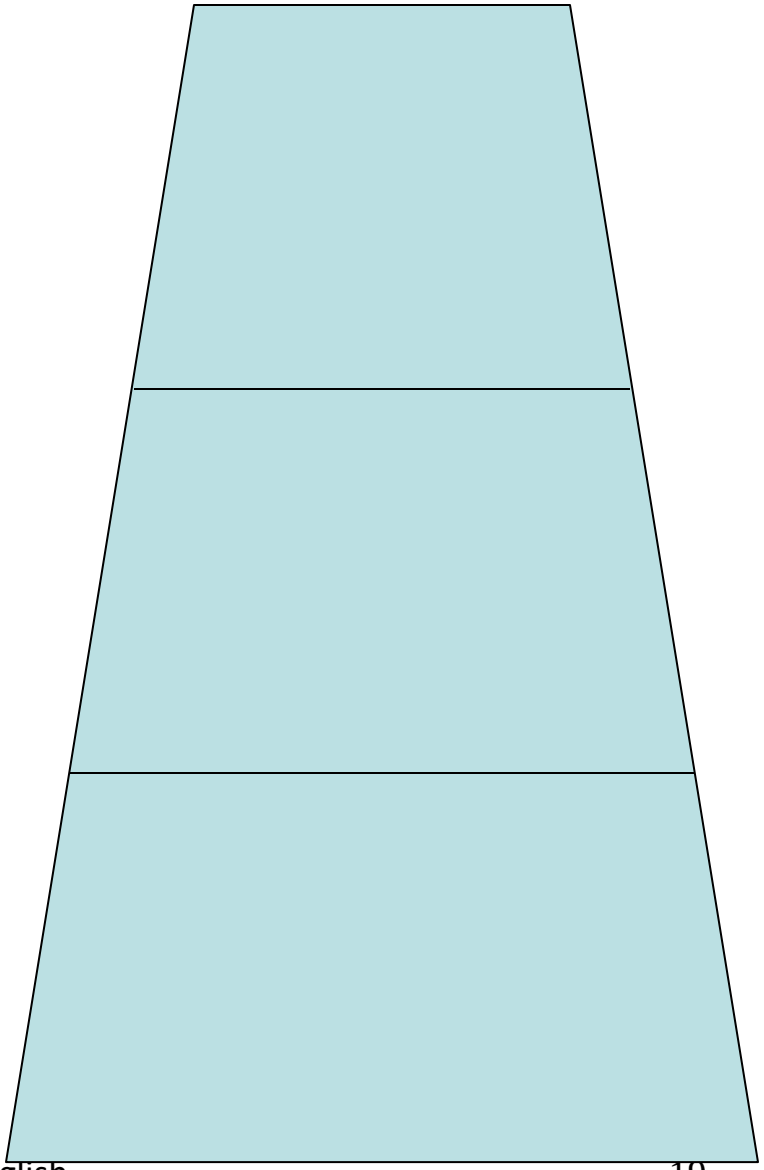
- Use figures (graphs, diagrams, maps, photographs, etc) only if they will help convey your information.
- Avoid including too much information in one figure.
- Make sure any lettering will be large enough once published.
- Follow the journal's instructions.

The Discussion

- Puts the results in their proper scientific context
- Answers the question “So what?”
- Explains the significance of the results
- Converts “information” into “knowledge”

Discussion Elements

Reminders (narrow focus)	1. Reference to main objective, hypothesis, or research question. 2. Review of the most important findings.
Interpretations (broaden focus)	3. Justifications 4. Limitations 5. Comparisons 6. Validations 7. Explanations
Implications (further broaden focus)	8. Generalizations 9. Significance 10. Recommendations



Typical Discussion Elements

- **Specific reference to the present study:**

1. Reference to main purpose or hypothesis
2. Review of the most important findings
3. Limitations and justifications:

   * Demonstration of self-consistency (e.g., with model assumptions)
   * Demonstration of statistical validity
   * Limitations of technique and their implications (e.g., bandwidth of instrument $\rightarrow$ high frequency components, if existent, cannot be observed)

Typical Discussion Elements continued

Specific reference to the present study (continued)

4. Comparisons

   * Between different elements of the present study

   * With previous works (between various theories, between various experiments, between experiment and theory, or theory and experiment)

Typical Discussion Elements continued

- **General statements**

5. Implications and generalizations
6. Recommendations
   * For future research
   * Practical applications

- Discussion starts with specific statements re. present study, and diverges towards more general statements

Author's attitude

Sliding scale of certainty for explanations and implications:

category	**use**	**key words**	**example**
speculation	idea or ideas that come to mind	may, possible, conceivably	*"A possible explanation is that the specimen may be heated by the process."*
likely	some evidence supports this idea	suggests, indicates	*"The increased electrical conductivity suggests that the sample is heated by the process."*

Sliding scale of certainty

very likely	substantial evidence supports this idea	is consistent, strongly suggest	*"The increased electrical conductivity as well as the increased radiance, strongly indicate that the sample is heated by the process."*
most likely	There is more evidence and/or theoretical support for this idea than any other existing idea	most likely	*"The most likely explanation for the increased electron emission is sample heating by the process."*
proven	All possible explanations are on the table, and a decisive test indicates that this idea and only this idea explains the observation	proven, proves, proof, shown, demonstrated	*"Thus it was proven that the increased electron emission is caused by process sample heating."*

Complex Structure in Discussion Statements

Main Clause	THAT	Noun Clause
(researcher's position)		**(information)**
Thus it was proven	**that**	**the increased electron emission is caused by process sample heating.**

Verb Tense

- **<u>Simple Past</u> – common in specific references to current study**

sentence type	**Example**
Refer to purpose	*"The objective of the present study was to correlate systolic anomalies with genetic factors."*
Refer to hypothesis	*"It was initially expected that instabilities would be observed above a threshold voltage."*
Refer to findings	*"However, constant output was observed for the entire range of parameters investigated."*

Verb Tense - explanations and limitations

condition	tense	example
generally applicable	present	"*Increased nitrogen incorporation produces harder coatings."*
restricted to this study	past	*"The increased coating hardness was the result of increased nitrogen incorporation."*
speculative	modal auxil.	*"The increased coating hardness may have been the result of increased nitrogen incorporation."*

Discussion Question

- If you have data that could be presented in either a table or a figure, how do you decide which one to use?

A General Suggestion

- Look at tables and figures in journal articles presenting research similar to yours
  - In your target journal
  - In other good journals
- Use these tables and figures as models when designing your own tables and figures.

Sources of Further Information

- "*Almost* Everything You Wanted to Know About Making Tables and Figures," Department of Biology, Bates College (http://abacus.bates.edu/~ganderso/biology/resources/writing/HTWtablefigs.html)
- Writing and Publishing Scientific Papers, Part 2 (from China Medical Board course), accessible at http://www.authoraid.info/resource-library?type=all&subject=preparing_tables_and_figures&lang=all

Sources of Further Information (cont)

- How to Display Data in Tables & Graphs—July 2010 presentation at CVM by Tom Lang (of Tom Lang Communications)—will be e-mailed to Sabrina for distribution

Tables and Figures

- Look at the tables and figures in a paper that you brought or were given.
  - What are some strengths of these tables and figures?
  - What do you think could have been improved?
  - What other observations or questions do you have?
- Be ready to present your thoughts.

The Abstract

First to Be Read

but Last to Be Revised

The Abstract

- Briefly summarizes the paper
- Gives editors and peer reviewers their first impression of the paper
- Tends to be widely read
- Should be organized like the paper (for example, in sort of a mini-IMRAD format)
- Some journals have structured abstracts (with standardized headings)

The Abstract (cont)

- Should be carefully revised before the paper is submitted
- Be sure the content is consistent with that in the body of the paper.
- Be sure to include only content that appears in the paper.

A Resource:

“Writing the Scientific Abstract”