Your Observations…

• What are some observations you made about the **Introductions** you collected from the published literature?

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Meeting 2: Methods

*If a man can group his ideas, then he is a writer.*

*Robert Louis Stevenson*
What are Some Approaches to Writing Scientific Papers?

- **Model** your writing after someone in your field who is **an especially good writer**.

- Consult **texts on scientific writing**.

![Linus Pauling](image)

**Good MIT Resources**

- [http://web.mit.edu/writing/temp2/home.htm](http://web.mit.edu/writing/temp2/home.htm)
- The Writing Center
  - 14N-317
  - 235-3090
  - Appointment preferred but not required
Some Good Resources for Those in Need

Develop a Detailed Outline

- The Mayfield Handbook: Section 1.5.1
- [http://web.mit.edu/writing/temp2/home.htm](http://web.mit.edu/writing/temp2/home.htm)

- Outlines reduce and order your source materials.

- And outlines force you to:
  - partition material
  - develop a point of view
  - establish the scope of your document
  - sequence your topics
  - develop a writing strategy

- The same outline can be used to generate feedback, serve as a writing aid, and provide the subject headings of your paper.

- Work out a general plan first, and then make the outline more specific.
A Model of the Writing Process

**Episode 1: Planning**

**Goals/Questions**
- What do I know about my topic?
- What is my purpose for writing?
- Who are my intended readers and how much do they know about my topic?
- How is this task like others I have had before?
- What structure will work best for my topic?

**Strategies**
- Clustering
- Freewriting
- Conversation
- Brainstorming
- Research and research on your topic

**Episode 2: Drafting**

**Goals**
- Repeat planning questions
- Strive toward accurately rendering your intentions

**Strategies**
- Any or all of those you used for planning.
- Outlining
- Visual Representations of your topic

**Episode 3: Revising**

**Goals**
- Repeat planning/drafting questions
- Address Higher-Order Concerns rather than Later-Order Concerns

**Strategies**
- Any or all of those you used for planning and drafting
- Seeking feedback
- Glossing your text

**Episode 4: Editing/Proofreading**

**Strategies**
- Editing in several passes with a different focus on each pass
- Reading draft aloud

---

**Experienced Scientific Writers...**

- **Seek Feedback**
  - peer-edit
  - self-edit (after a long enough delay)
  - expert-edit

- Expect to **learn by writing** as well as to inform.

- Revise, revise, revise, revise, revise, revise, revise, revise,
Three Aspects of Writing Style

Figure 2.1. Aspects of style in professional writing.

Language: Needless Complexity

Table 8.1
Examples of Needlessly Complex Words

<table>
<thead>
<tr>
<th>Category</th>
<th>Example</th>
<th>Possible Substitute</th>
</tr>
</thead>
<tbody>
<tr>
<td>nouns</td>
<td>familiarization</td>
<td>familiarity</td>
</tr>
<tr>
<td></td>
<td>has the functionality</td>
<td>can function</td>
</tr>
<tr>
<td></td>
<td>has the operationability</td>
<td>can operate</td>
</tr>
<tr>
<td></td>
<td>utilization</td>
<td>use</td>
</tr>
<tr>
<td>verbs</td>
<td>facilitate</td>
<td>cause</td>
</tr>
<tr>
<td></td>
<td>finalize</td>
<td>end</td>
</tr>
<tr>
<td></td>
<td>prioritize</td>
<td>assess</td>
</tr>
<tr>
<td></td>
<td>utilize</td>
<td>use</td>
</tr>
<tr>
<td>adjectives</td>
<td>aforementioned</td>
<td>mentioned</td>
</tr>
<tr>
<td></td>
<td>discretized</td>
<td>discrete</td>
</tr>
<tr>
<td></td>
<td>individualized</td>
<td>individual</td>
</tr>
<tr>
<td></td>
<td>personalized</td>
<td>personal</td>
</tr>
<tr>
<td>adverbs</td>
<td>firstly, secondly, thirdly</td>
<td>first, second, third</td>
</tr>
<tr>
<td></td>
<td>heretofore</td>
<td>previous</td>
</tr>
<tr>
<td></td>
<td>hitherto</td>
<td>until now</td>
</tr>
<tr>
<td></td>
<td>therewith</td>
<td>with</td>
</tr>
</tbody>
</table>
Language: Needless Words

- (already) existing
- At (the) present (time)
- (basic) fundamentals
- (completely) eliminate
- (continue to) remain
- (currently) being
- (currently) underway
- (empty) space
- Had done (previously)
- Introduced (a new)
- Mix (together)

- Never (before)
- None (at all)
- Now (at this time)
- Period (of time)
- (private) industry
- (separate) entities
- Start (out)
- Write (out)
- (still) persists

Language: Strong Versus Strong Verbs

- made the arrangement for
- made the decision
- made the measurement of
- performed the development of

- arranged
- decided
- measured
- developed
Language: Passive Versus Active Voice

• The voltage was displayed by the oscilloscope.

• The feedthrough was composed of a sapphire optical fiber, which was pressed against the pyrotechnic that was used to confine the charge.

• The oscilloscope displayed the voltage.

• The feedthrough contained a sapphire optical fiber, which pressed against the pyrotechnic that contained the charge.

Vigorous Writing is Concise

Advice from the Authorities

The Elements of Style
by William Strunk, Jr., and E. B. White

Omit needless words. Vigorous writing is concise. A sentence should contain no unnecessary words, a paragraph no unnecessary sentences, for the same reason that a drawing should have no unnecessary lines and a machine no unnecessary parts. This requires not that the writer make all his sentences short, or that he avoid all detail and treat his subjects only in outline, but that every word tell...

Avoid fancy words. Avoid the elaborate, the pretentious, the coy, and the cute. Do not be tempted by a twenty-dollar word when there is a ten-center handy, ready, and able.... All [words] are good, but some are better than others.
“Experimental Section”
According to Paradis and Zimmerman

Experimental Section. The experimental section of an article describes the tools and processes that enabled you to meet the stated objectives of the introduction. This section is sometimes called materials and methods, experimental methods, procedure, or experimental apparatus, depending on the stylistic preferences of the journal. The section will be read for at least two major reasons. First, readers will judge how skillfully you have designed the empirical processes of problem solving. Second, readers may test your methodology against your results in their own laboratories.

In experimental sections, clarity and accuracy are priorities. You are describing a variety of objects and processes that have been used to deliver a set of data. Include significant numbers, but move detailed analyses to appendixes.

Instructions to Authors
J. Bac., Materials and Methods

Background rather than an exhaustive review of the topic.

Materials and Methods. The Materials and Methods section should include sufficient technical information to allow the experiments to be repeated. When centrifugation conditions are critical, give enough information to enable another investigator to repeat the procedure: mass of centrifuge, model of rotor, temperature, time at maximum speed, and centrifugal force (e.g., rather than revolutions per minute). For commonly used materials and methods (e.g., media and protein concentration determinations), a simple reference is sufficient. If several alternative methods are commonly used, it is helpful to identify the method briefly as well as to cite the reference. For example, it is preferable to state “cells were broken by ultrasonic treatment as previously described (9)” rather than to state “cells were broken as previously described (9):” The reader should be allowed to assess the method without constant reference to previous publications. Describe new methods completely and use sources of unusual chemicals, equipment, or microbial strains. When large numbers of microbial strains or mutants are used in a study, include tables identifying the sources and properties of the strains, mutants, bacteriophages, plasmids, etc.

Enzyme purifications should be described in this section, but the results of such procedures should be described in the Results section.

A method, strain, etc., used in only one of several experiments reported in the paper may be described as the Results section or very briefly (one or two sentences) in a table footnote or figure legend.

Results. The Results section should include the results of the experiments. Reserve extensive interpretation of results in the discussion section.
Organization is hidden when headings occur in a long list without secondary headings

<table>
<thead>
<tr>
<th>Performance of the Solar One Receiver</th>
<th>Performance of the Solar One Receiver</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>Introduction</td>
</tr>
<tr>
<td>Steady State Efficiency</td>
<td>Receiver’s Efficiency</td>
</tr>
<tr>
<td>Average Efficiency</td>
<td>Steady State Efficiency</td>
</tr>
<tr>
<td>Start-Up Time</td>
<td>Average Efficiency</td>
</tr>
<tr>
<td>Operation Time</td>
<td>Receiver’s Operation Cycle</td>
</tr>
<tr>
<td>Operation During Cloud Transients</td>
<td>Start-Up Time</td>
</tr>
<tr>
<td>Panel Mechanical Supports</td>
<td>Operation Time</td>
</tr>
<tr>
<td>Tube Leaks</td>
<td>Operation During Cloud Transients</td>
</tr>
<tr>
<td>Conclusion</td>
<td>Receiver’s Mechanical Wear</td>
</tr>
<tr>
<td></td>
<td>Panel Mechanical Supports</td>
</tr>
<tr>
<td></td>
<td>Tube Leaks</td>
</tr>
<tr>
<td></td>
<td>Conclusion</td>
</tr>
</tbody>
</table>

What are Some Goals of a Methods Section?

- Present the **experimental design**.

- Provide enough detail to allow readers to **interpret your results** (virtual witnessing).

- Give enough detail for readers to **replicate** your work.
What are Some Pitfalls of a Methods Section?

- Providing too little or too much information.
- Reiterating published methods rather than citing them.
- Writing strictly in chronological order (alternatives: most important first, most fundamental first, etc.).
- Methods and results don’t correspond (you have to provide methods for all the experiments you report).
- Forgetting to use visual organizers that direct readers to specific aspects of the methods section, e.g., subheads (see next slide).
- Writing a protocol instead of a methods section. Methods are written in narrative form in past tense.

Today’s In-Class Exercises

- Go to the discussion board and complete the activity posted for Meeting 2.
- Examine the methods sections of two published papers distributed in class. Break into groups to discuss the merits and failings of these methods sections.
- Edit the methods section distributed in class.
Today’s Out-of-Class Exercises

• Write methods sections (based on your lab notebook) for two experiments from the Genetics or Protein Biochemistry Module.
  – Be sure you write a Methods Section and not a Protocol.

• Read “The Science of Scientific Writing” and be prepared to discuss it at the next meeting.

• Write the Methods Section for your long-term project.

• BRING LAB NOTEBOOKS TO NEXT CLASS