Why am I here?

• Nine lectures / workshops on Scientific Writing

• One lecture / workshop on Oral Presentations

• One-on-one help during office hours
  – Please leave plenty of lead time before your due dates
Meeting 1
Basic Scientific Communication

We are all apprentices of a craft where no one ever becomes a master.
Earnest Hemingway

Photo courtesy of Dr. William Calvin (http://www.williamcalvin.com/index.html).
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Scientific Writing and Speaking

- Who likes it?
- Who hates it?
- Who’s good at it?
- Who’s bad at it?
Some Good Resources


Good MIT Resources


What is the Purpose of Scientific Communication?

- **Inform**: Communicate the most information with least reading time.

- **Persuade**: Present logical arguments in a convincing manner.
What are the Constraints on Scientific Communication?

- **Audience:**
  - Who, What, Why, How

- **Format:**
  - Formats vary

- **Mechanics:**
  - Frustrating because of many inconsistent rules and lots of gray areas.

- **Politics:**
  - Try to remain honest
The Writing Process: Step 1

READ
THINK
TALK

• Do this to develop a clear idea of your thesis…

• …and to develop a strategy for your writing.

• Clear writing is impossible in the absence of clear thinking.

Photo courtesy of Dr. William Calvin (http://www.williamcalvin.com/index.html). Used with permission.
The Writing Process: Step 2

DEVELOP AN OUTLINE

An outline is an overview…
…it can help you:

– **Isolate topics** (use keywords)
– **Partition** topics into **subcategories**
– **Sequence** topics
– **Identify gaps**
– **Eliminate unnecessary content**
– **Get feedback**

*These activities are accomplished more efficiently with an outline than with a draft.*
The Writing Process: Step 3

WRITE

- Fill in the content of your outline in any order you like.

- Make sure you state your thesis in the introductory paragraph.

- Be sure to use topic sentences in each paragraph.

- Make all sentences within a paragraph pertain to the topic sentence.

- Make intelligent transitions between paragraphs.

*Photo courtesy of Dr. William Calvin ([http://www.williamcalvin.com/index.html](http://www.williamcalvin.com/index.html)). Used with permission.*
The Writing Process: Step 4

REVISE  REVISE  REVISE

– Reread and revise on your own.

– Revise on the basis of feedback from your peers.

– Revise on the basis of feedback from me.

– Revise on the basis of feedback from Drs. Sabatini and Burge.

Photo courtesy of Dr. William Calvin (http://www.williamcalvin.com/index.html). Used with permission.
Three Aspects of Writing Style

Aspects of Style in Professional Writing

Figure by MIT OCW.
What We Look For in Structure (checklist)

Structure
Title:
does not orient (17)
is too long (18)
Introduction:
does not define scope (27)
does not show importance (28)
does not give background (30)
does not map (31)
Conclusion:
does not analyze (41)
does not provide closure (41)
Transitions into sections:
first sentences abrupt (55)
reader not oriented (54)

Summary:
does not map, if descriptive (22)
does not inform, if informative (23)
Middle:
strategies illogical (33)
headings not descriptive (38)
headings not parallel (39)
deepth inappropriate (59)
Appendices:
are not introduced in text (49)
do not stand alone (47)
Emphasis of results:
repetition not used well (64)
placement not used well (66)

Figure by MIT OCW.

Aspects of Style in Professional Writing

- Style
  - Structure
  - Illustration

- Language
  - Precision
  - Clarity
  - Forthrightness
  - Familiarity
  - Fluidity
  - Conciseness

- Choice
  - Design

Organization
Emphasis
Transition
Depth

Choice
Design

Conciseness
Fluidity
Familiarity
Forthrightness
Clarity
Precision
A hierarchy of language goals in professional writing.

Figures by MIT OCW.
What We Look For in Language (checklist)

Language
Imprecision, word choice (73)
Needless complexity:
in word choice (84)
in noun phrases (85)
in sentence structures (86)
Too many abstract nouns (102)
Tone not controlled (97)
Terms undefined (112)
Needless words (119)

Imprecision, level of detail (78)
Ambiguities:
from word order (92)
from unclear pronouns (93)
from punctuation error (94)
too many passive verbs (104)
Discontinuity:
from stagnant rhythms (129)
from poor transitions (137)

After Alley, 1996.
Language: Word Choice

A hierarchy for commonly confused word pairs (an issue of usage) in professional documents. A discussion of each word pair appears in the Appendix.

Errors that would unsettle many readers:
- affect, effect
- its, it’s
- lead, led
- principal, principle
- lie, lay

Errors that would distract many readers or change the sentence’s meaning:
- than, then
- a, an, the
- amount, number
- phenomenon, phenomena
- criterion, criteria
- continual, continuous
- fewer, less
- adverse, averse
- good, well
- that, which
- medium, media
- stratum, strata
- compose, comprise
- who, whom
- as, like
- anxious, eager
- ensure, insure
- enormity, enormousness
- nauseated, nauseous

Errors that would distract only a few readers:
- farther, further
- more than, over
- alternate, alternative, option
- compare to, compare with
- different from, different than
- because of, due to
- if, whether
- more important, more importantly

After Alley, 1996.
## Language: Needless Complexity

### 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 functionability</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, Second, 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>

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*After Alley, 1996.*
Language: Too Many Abstract Nouns

• Original:
  – *The existing nature of Mount St. Helens’ volcanic ash spewage was handled through the applied use of computer modeling capabilities.*

• Revised:
  – *With Cray computers, we modeled how much ash spewed from Mount St. Helens.*
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

After Alley, 1996.
Language: Ambiguities

• Word Choice:
  – *T cells, rather than B cells, appeared as the lymphocytes migrated to the thymus gland.*
  – *T cells, rather than B cells, appeared because the lymphocytes migrated to the thymus gland.*

• Syntax: (the ordering of words within a sentence)
  – *In low water temperatures and high toxicity levels of oil, we tested how well the microorganisms survived.*
  – *We tested how well the microorganisms survived in low water temperatures and high toxicity levels of oil.*

• Pronouns: (particularly “it” and “this”)
  – *Because the receiver presented the radiometer with a high-flux environment, it was mounted in a silver-plated stainless steel container.*

After Alley, 1996.
Language: Strong Versus Strong Verbs

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

- arranged
- decided
- measured
- developed

After Alley, 1996.
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.

After Alley, 1996.
Why Use Strong Verbs and Active Voice?

• Because they’re lively and require fewer words.

Photo courtesy of Dr. William Calvin (http://www.williamcalvin.com/index.html). Used with permission.
| Errors that would unsettle many readers | run-on sentence (comma splice)  
fragment  
missing introductory comma  
major usage error (its, it's)  
misspelling (spell checker would catch) |
|----------------------------------------|----------------------------------------------------------------------------------|
| Errors that would distract many readers or change the sentence's meaning | unclear pronoun reference  
missing parenthetical comma  
subject-verb disagreement  
verb tense error  
faulty parallelism  
missplaced modifier  
usage error (criterion, criteria)  
irregardless  
alright  
typo (spell checker would miss)  
missing series comma  
colon error  
semicolon error  
possessive error  
center around  
very unique  
capitalization error  
quotation marks misplaced  
numeral error  
subjunctive error. |
| Errors that would distract only a few readers | data used as singular  
ending sentence with preposition  
split infinitive  
contractions such as can't  
minor usage error (if, whether)  
panacea for |

A hierarchy for grammar, punctuation, usage, and spelling errors in a professional document. A discussion of each listing appears in the Appendix.

After Alley, 1996.
What We Look for in Illustrations (checklist)

Illustration
- Illustration is not introduced (162)
- Illustration is not discussed (164)
- Illustration does not mesh (164)
- Caption is not specific (163)

Illustration is misplaced (167)
- Illustration raises question (161)
- Label is missing or incorrect (162)
- Caption has incorrect form (163)

After Alley, 1996.
Choose the Right Type of Illustration

- **Charts and graphs**: convey trends, comparisons, relationships
  - **Line graphs**: trends
  - **Bar graphs**: magnitude
  - **Pie charts**: relative portions of the whole

- **Photographs**: provide absolute proof

- **Chemical structures, reactions, mathematical expressions**: essential for theories and processes
Proper Form for Tables

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“Column dimensions in ACS Publications.”
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What We Look For in Format (checklist)

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Format: Headings

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Format; Citations

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Format: Reference List

Periodicals

Recommended Formats

Author 1; Author2; Author 3; etc. Title of Article. *Journal Abbreviation* Year, *Volume*, Inclusive Pagination

Author 1; Author2; Author 3; etc. *Journal Abbreviation* Year, *Volume*, Inclusive Pagination

Source: ACS Style Guide.
Formatting Instructions

• DOUBLE SPACE all documents
• Always include page numbers
• Laser quality print
• Time or Times New Roman font
• 12 pt
• Standard manuscript paper 8 1/2 x 11
• 1 side of paper
• 1 column
• Ragged right
• 1-inch margins
Vigorous Writing is Concise

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