SCIENTIFIC WRITING: THE BASICS
“Writing is not a career; writing is a skill that all professionals need to do their jobs.”

“Writing is not just a mechanical tool that doctors need to use, like a scalpel; learning to use language well is basic to a doctor’s ability to communicate deeply with patients, to find the right words for the right moment, and to address ethical problems with sensitivity and critical awareness.”

“...the ability to clearly communicate one’s research findings determines the extent to which those findings can be used as the basis for research by others.”

Cameron et al, 2009.
Professional Writing

- Scientific publications
- Abstracts and poster presentations
- Patient documentation
- Promotional and education materials
- Correspondence with vendors, insurance, etc.
- Organizational participation
- Grant applications
What Sets Scientific Articles Apart

- More formulaic in structure
- Focus is on clarity and conciseness
  - Clarity = use the most precise words and phrases so that nothing is left up to the reader’s interpretation
  - Conciseness = use bigger words and longer sentences only if necessary
Structure: IMRAD

- **I**: Introduction
- **M**: Methods
- **R**: Results
- **D**: Discussion

Can apply this structure to non-research articles, such as case series and literature reviews.
## Break It Down: Questions

<table>
<thead>
<tr>
<th>This section...</th>
<th>...should answer:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>Why did you do the project? What did you hope to learn?</td>
</tr>
<tr>
<td>Methods</td>
<td>How did you conduct the research? Who/what was involved? When was the study done/what was the time frame?</td>
</tr>
<tr>
<td>Results</td>
<td>What did you find?</td>
</tr>
<tr>
<td>Discussion</td>
<td>What did you learn in relation to your hypothesis? What is the significance? What are the limitations? Where does the research go from here?</td>
</tr>
</tbody>
</table>
Introduction (a.ka., Background)

Why is your research of scientific interest? Why are you asking the question?
Methods

- Provide enough information to allow other researchers to replicate your experiment or study.
- “If you’re going to trash a paper, do so before reading the results.”
- What can go wrong: IRB approval, human subjects protection, blinding, inclusion and exclusion criteria, randomization, follow-up period, endpoints, reproducibility, statistical analyses, etc.
Results

- What did you find?
- No interpretation here
- Use tables and figures to present your data
- Include statistical analyses

Table 1. Hg levels in test specimens from the parietal lobe of cadavers.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Group</th>
<th>Age</th>
<th>Gender</th>
<th>Number of amalgams</th>
<th>Hg (µg/g)</th>
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</table>

Hg: mercury.

Diagram:

- Define acronyms
- Identify units
- Label axes
- Age group
- Amalgam +
- Amalgam -
- 10-20
- 21-40
- 41-60
- 61-80
Discussion

- Looking at the forest, not the trees

Address results in light of purpose statement/hypothesis

- Limitations
- Clinical implications
- Next steps/recommendations/further research
References

- Two parts: references in the text and citations at the end
- Following the journal’s formatting style
- Numbered references use the order in which they are cited
- Provide sources appropriately: “A study said...” requires a reference
- To reprint figures and tables, obtain permission from the copyright holder (exceptions: federal publications)
More About References

- Don’t insert references after every consecutive sentence
- If 2 chapters from the same book are used, list each reference separately
- **Cite your sources as you find them and use them!**
Plagiarism and Copyright

- Plagiarism and copyright are different: ethical vs. legal
- Be sure to paraphrase and summarize your source material
- Don’t copy and paste text
- Using a thesaurus to change every other word is not paraphrasing
- Credit your sources, whether from text or the Web
- When writing for publication, you must obtain permission to use images and tables
Don’t Forget the Abstract

- Is the first contact reviewers and potential readers will have with your work: Don’t make it their last
- Provides a succinct and straightforward summary
- Can be structured or unstructured
- Does not include figures, tables, or references
- Only include information that is also within the manuscript
- Be sure that the abstract and manuscript agree, particularly the data
Authorship Issues

“An author must take responsibility for at least one component of the work, should be able to identify who is responsible for each other component, and should ideally be confident in their co-authors’ ability and integrity.”

*International Committee of Medical Journal Editors*

- Journals usually require all authors to complete forms regarding conflicts of interest, role, copyright...
- Copyright is usually assigned to the publisher (NOT the author) unless authors take specific actions
Picking a Journal

- Considerations
  - Impact factor and other metrics
  - Open/public access
  - Good fit for topic
  - Accept your type of article
  - Publication fees

- Read the author instructions
A Digression…

- **Impact factor**
  - Citation measure produced by Thompson Scientific's ISI Web of Knowledge database; only measures ISI-indexed publications

- **Examples of alternative metrics**
  - Eigenfactor
  - Immediacy Index

- **Open access**
  - Gold: journals with no subscription fees;
  - Green: manuscripts deposited in institutional or subject repository, e.g., NIH/NSF directives
  - Predatory publishers: charge large fees to authors without providing the editorial and publishing services and engage in other fraudulent activities
Submitting Your Article

- FOLLOW THE DIRECTIONS!
- Electronic submission system
- You may need:
  - Cover letter that includes specific information
  - Author forms
  - Written permission to reuse figures/tables
  - Written patient consent
  - Review suggestions
  - Blinded manuscript
  - Figures of a specific file type
After Submission

- Peer review process (a.k.a., refereeing)
  - Quality control measure
  - Article sent to individuals with similar expertise, interests
  - Takes a few days to several months

- Possible outcomes
  - Accepted
  - Accepted with minor revisions
  - Major revisions and will reconsider
  - Declined
Getting Started

1. OK, I NEED TO TRANSFER MY THOUGHTS FROM MY HEAD TO THIS SCREEN...
2. C’MON, WRITE!
3. WRITE! WRITE!
4. THEY’RE TOUCHING! TRANSMIT! TRANSMIT!

www.phdcomics.com
Getting Started

- Schedule regular times to write, turn off email, and shut the door
- Put something on the screen from the outset
- Explain your idea to someone else, verbally (or on paper (e.g., “Dear Mom” letter))
- Use voice recognition software
- Take regular breaks
- Reward yourself for success
Proofread, Proofread, Proofread

- "When you have done your article, give it to a friend, if possible a fairly ignorant one." J. B. S. Haldane, on science writing

- Review and revise your paper; read it several times. Read it again the next day

- Do not depend on the spelling checker to catch all typos and spelling errors
And now, the English language...
Good Scientific Writing

- Use words your readers will understand and define terms they may not know
- Use plain language when possible, not jargon
- Use punctuation to make sentences more understandable

- Be clear and direct in your writing!
Structuring Your Writing

- Put the most important information at the beginning and end of paragraphs and sections.
- Place information you want to emphasize at the end of a sentence.
  - Although the treatment has significant side effects, it is highly effective.
  - Although the treatment is highly effective, it has significant side effects.
Our findings have resulted in an improved understanding of the probable types of transmission, as well as a means of identification of patients at risk for infection.

From our findings, we understand better how the infection is transmitted and how to identify at-risk patients.
Write Directly

- Avoid weak adverbs
  - Words such as rather, very, little, pretty, fairly
  - Ex: This method was very effective and was pretty easy to use.

- Tighten your language
  - Our results are in agreement with…
    - Our results agree with…
  - We performed an analysis of the data.
    - We analyzed the data.
Active vs. Passive Voice

- Active voice is less wordy and more direct; it provides more information
  - Two procedures were performed on each cementation.
    - We performed two procedures on each cementation.
  - A term paper was assigned to the class.
    - The instructor assigned a term paper to the class.
Active vs. Passive Voice

- In a few instances, passive voice is more appropriate
  - When the doer is unknown:
    - The gold crown was made many years ago.
    - Dr. Smith was named chairman of the department.
Misplaced Modifiers and Dangling Participles

  - While I was running for the bus, my book fell in the mud.

- A large mass of literature has accumulated on the cell walls of staphylococci.
  - The literature contains numerous articles about the cell walls of staphylococci.

- Women are more likely to take vitamins than men.
  - Women are more likely than men to take vitamins.
Agreement

- Nouns and pronouns should be consistent in person and number.
  - Cements have characteristics that affect its ability to bond. ✗
  - When a patient has dental pain, they want immediate relief. ✗

- Subjects and verbs: singular or plural
  - The treatment effects of the fluoride varnish for dentin hypersensitivity is based on the appropriate maintenance of the varnish in the mouth for a certain period of time. ✗
Avoid abstract nouns and verbs

- The epithelial cells exhibit proliferation.
  - The epithelial cells proliferate.

- We conducted comparisons of manual and electronic toothbrushes.
  - We compared manual and electronic toothbrushes.

- A reduction in fluoride levels in drinking water was observed.
  - Fluoride levels in drinking water were reduced.
  - Even better: Fluoride levels in drinking water decreased by 32%.
Avoid there is/are

- There are several techniques that have been approved for the relief of TMJ pain.
  - Several techniques have been approved for the relief of TMJ pain. (Further problem with this one?)
- There are two types of veneers on the market today.
  - Two types of veneers are on the market today.
Write Clearly

- Do not begin a sentence with “This/These” unless followed by a noun
  - This was the wrong category.
    - This category was wrong.

- Do not begin a sentence with “It”
  - It was assumed that by sandblasting...
    - The researchers assumed that by sandblasting...

- Always include the unit when stating numbers/data
  - 140/80 mmHg, BMI = 29 kg/m², 12 years
Words and Phrases to Avoid

- **utilize** → **use** (but try not to use **use** too often: find a better verb)
- **at this point in time** → **now**
- **fewer** → **in number**
- **combine** → **together**
- **in order to**
- **adequate** → **enough**
- **tender** → **to the touch**
- **completely** → **full/empty**
Colloquialisms: Just Say No!

- **deals with:** This paper deals with caries.
- **things:** Many things went wrong.
- **gotten:** This technique has gotten more popular.
- **done on:** Research has been done on composite resins.
- **get:** Due to his habit of chewing tobacco, he got oral cancer.
Proper Usage

- **Due to vs. because of**
  - The FDA stopped the trial because of adverse events, including death.

- **Over vs. more than**
  - More than 600 patients participated in the study.

- **That vs. who**
  - The patient who came in yesterday is disabled.
Abbreviations and Acronyms

- When using abbreviations, write out the full name the first time you use it:
  - I attend the Louisiana State University School of Dentistry (LSUSD), located near City Park in New Orleans. LSUSD was established in 1968.

- Remember that the same acronym can be interpreted differently (US, SSA, BS, CID, GFR)
Avoid Contractions

- it’s
- they’re
- don’t, didn’t
- won’t, wouldn’t
- can’t, couldn’t
Commonly Confused Words

- two, too, to
- four, for; fourth, forth
- their, there, they’re
- buy, by, bye
- lose, loose, loss
- advice, advise
- principle, principal
- complementary, complimentary
- ensure, assure, insure
- very, vary
Commonly Confused in Science

- **effect (noun)**
  - The drug had a minimal *effect* on the disease.

- **affect (verb)**
  - The drug minimally *affected* the disease.

- **The exception:** when affect is used as a noun in psychology
  - When the picture of a dog flashed on the screen, Mr. Smith’s *affect* was sudden and violent.
Preferred Terms

- Preventive
- Dietitian
- Hodgkin disease
- Patients vs. cases
- Persons vs. patients (patients are being treated)
- Gender vs. sex (cultural vs. biological)
- Regimen
- Died
Hyphen Use

- Use hyphens to combine two or more words into a compound qualifier/descriptor:
  - first-year dental students
  - award-winning poster
  - 2-year-old female
  - one-step self-etch system

- But...
  - comfortably numb patient, 2 years old, toothache
Common Latin Abbreviations

- Replace with English when possible
- i.e. = *id est* = “that is”
- e.g. = *exampli gratia* = “for example”
- et al = *et alia* = “and others”
  - Used in reference lists for articles with more than 6 authors
  - In text, use et al when more than 2 authors:
    - Smith and Jones reported on the research.
    - Smith et al reported on the research.
Research & Writing Resources

- Duke Scientific Writing Resource
- Easily Confused Words
- Scientific Writing
- International Committee of Medical Journal Editors
- Preventing Plagiarism When Writing
- Purdue Online Writing Lab: General Writing Resources
- Responsible Authorship Quick Guide
- Writing the Scientific Paper (Colorado State)
Writing Resources in the Library

- Publishing and Presenting Clinical Research
- Medical Writing
- How to Write and Publish a Scientific Paper
- Research Writing in Dentistry
- From Research to Manuscript
- The Complete Guide to Medical Writing
- Scholarly Communication LibGuide
- Scientific Papers and Presentations