Scientific Writing for Diverse Purposes

G-RISE at CCNY 2023

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Who is Beth Schachter?

Science communications consultant, editor, coach, science writer

STILL POINT
COACHING & CONSULTING
SCIENTISTS AT THEIR BEST

With Chris Edwards

HMS BEAGLE
The BioMedNet Magazine

Our upcoming workshop at CCNY

Science communications consultant, coach, in collaboration with

Assoc Dean for DEI and Professional Development
Zucker School of Medicine at Hofstra/Northwell

We return to CCNY for workshop on mentoring in a cross-cultural environment

In my previous life

Faculty member (PI) - Mount Sinai Medical School,

Depts. of Obs/Gyn and Cell Biology

Postdoc - UCSF and Columbia

Molecular Endocrinology, Neuroendocrinology

PhD - University of Southern California

Cell & Molecular Biology

BS - Antioch College (a work-study institution)

Co-op jobs at MIT, Polaroid PChem Lab, Tufts Dental Biochem

Other key training

Gotham Nonfiction Writing Workshop

writing beyond science

Toastmasters

public speaking, leadership

PDF of this presentation will go on Slack site along with my 2020 presentation

#sciencecommunication channel

Scientific Writing for Diverse Purposes

- **For thinking and gaining clarity**
- **For communicating with mentors and collaborators**
- **For communicating to a wider audience**

Today's presentation

- **Scientific writing for diverse purposes**
  - **Challenges and ways to overcome them**
- **A focus on writing manuscripts for publication**
  - **Including some scribbling for yourself**
- **ChatGPT gives my presentation**

Writing scientific documents is a multistep process:

1. Write (for self)

↓

2. Edit/Rewrite (for collaborators)

↓

3. Edit/Rewrite (for target audience)

1. Writing for thinking and gaining clarity

Part of the creative process

When do you start writing a scientific document?

- **When you have everything worked out in your head?**

Or

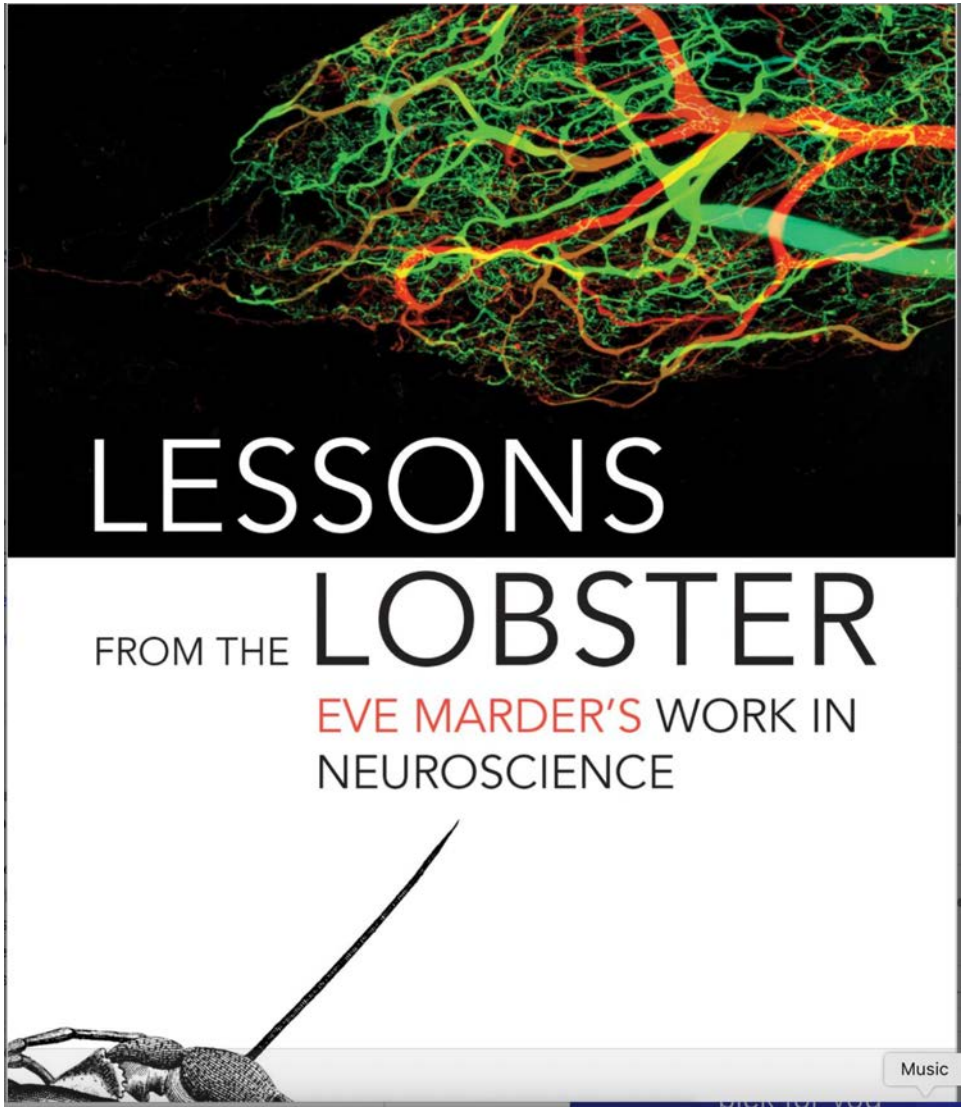
- **In order to work things out?**

I encourage writing as part of doing your research

Not just protocols and results

Write thoughts, questions, ideas, plans...
as they develop
and to develop them

Window into a scientist who wrote her thoughts as well as her research plans and results



2. Writing to communicate with collaborators

- **Communication between experts**
  - **Involves liberal use of technical jargon**
- **Often ongoing informal conversations**
  - **Background info optional; get right to the new stuff**

2a. Writing in collaboration with others

You all might have lots to teach each other and me about team writing.

Let's discuss later, if time permits.

3. Writing to communicate to a wider audience

Rewriting and editing documents for release to target journal, funding agency, etc.

Switch perspectives

From the writer

To the reader

Readers want easily understood writing

especially when the writing covers complex ideas

Scientific writing is often hard to understand

because published version hasn't been fully converted to a reader-friendly form

In other words,
scientific documents often need more work at step 3.

1. Write (for self)

↓

2. Edit/Rewrite (for collaborators)

↓

3. Edit/Rewrite (for target audience)

Tip: Before submitting final product, have it read by experts AND non-experts

Experts spot technical problems but may *subconsciously* fill gaps, clarify murkiness for themselves

Non-experts can identify murkiness – parts that don't make sense of flow well

How to make science documents more reader-friendly?

The most important tip for writing reader-friendly scientific documents*

Give familiar information before new information.

From *The Science of Scientific Writing*, by G. Gopen & J. Swan. (American Scientist, 1990)

Give familiar information before new information

Do this: *In sentence 2, familiar info comes first*

Samantha takes her dog to the dog park near her house. The dog park is maintained by the city of San José to promote healthy lifestyles.

Don't do this: *In sentence 2, new info comes first*

Samantha takes her dog to the dog park near her house. The city of San José maintains the dog park to promote healthy lifestyles.

Give familiar information before new information

Do this: ***In sentence 2, familiar info comes first***

Synthetic lethality involves the death of cells in response to individual mutations in two separate genes, neither of which is lethal alone. This phenomenon appears promising as a framework for cancer drug development.

Don't do this: ***In sentence 2, new info comes first***

Synthetic lethality involves the death of cells in response to individual mutations in two separate genes, neither of which is lethal alone. Cancer drug development appears to benefit from using this phenomenon as a framework.

For many more writing tips
see G-RISE Slack Channel
#sciencecommunication

Strategies, Tactics & Writing Tips
for Effective STEM Communication
G-RISE at CCNY 2020

Now you get to scribble

To bring what I'm saying into you own work

What is the next professional document you will write?

- Research manuscript draft
- Fellowship application
- Meeting abstract
- Dissertation
- Application for next position
- Tweet/blog post
- **Etc.**

Scribble note to self

Planning and organizing the document

For each of your writing projects, ask yourself:

What is your objective/goal?

What is your message?

Who is your audience?

*For your next writing project: what's your **objective**?*

- Publishing your research findings and ideas
- Obtaining funding
- Moving towards completing PhD
- Presenting your work at a meeting
- Expanding the audience for your new publication
- Other

Scribble answer(s) to self

*For your next writing project: what is your **message**?*

- You have made a great discovery
- Your discovery disagrees with other published work on the topic
- You have new insights based on someone else's work
- Other

Scribble answer to self

For your next writing project: who is your audience?

- **For peer-reviewed manuscript,**
  - **Mentors and collaborators**
  - **Busy editors and picky reviewers**
  - **Interested colleagues in your field**
- **For fellowship applications**
  - **Mentors and collaborators**
  - **Program officers and scientific reviewers**
  - **Professional references**
- **For tweet/blog postings**
  - **Colleagues and competitors**
  - **Lay readers**

Scribble answer to self

Writing the document

Let the answers to the

objectives/message/audience

questions help shape your STORY

Using objectives/message/audience to shape your story

Remember:

- **"Story" of new research findings may differ for a bioscience vs a computational science journal**

- **Story told in a fellowship proposal to the NIH differs from that to the NSF or a private foundation**

A focus on the Research Manuscript

- As grad students, seize the opportunity to do as much "first drafting" as you can
- Even if English is not your first language

When you do this, you need to work in a timely fashion

A focus on the Research Manuscript

Jot down a working title
for your next manuscript

The research manuscript: Finding and Crafting the story

Story-finding can start with figure captions

For your next manuscript, for each figure/table, write one sentence stating

- **the question that you asked**
- **what was learned (not what was done)**

This becomes core of the story

Start writing captions long before the research is done

This helps reveal what else needs doing and when you have enough for a paper

Next, step back from results and consider bigger picture

Crafting the story for a research manuscript

Abstract = the manuscript story in miniature

Write a draft abstract early in the research process

This helps the "story" emerge before the work is all done

Abstract = the manuscript story in miniature

- General state of the field?
- Specific question, knowledge gap or controversy?
- Approach
- Answers to specific questions
  - One answer per figure
  - Bigger questions answered by combo of figures
- Contribution to answering general question
- Novelty and significance
  - Findings that it supports and extends
  - Doors that it opens, paradigms that it overturns

Exercise: Crafting the story for a research manuscript

- General state of the field?
- Specific question, knowledge gap or controversy?
- Approach
- Answers to specific questions
- Contribution to answering general question
- Novelty and significance
  - Findings that it supports and extends
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Scribble few words per point

The scribbles you just made =

rough outline of manuscript abstract

Crafting the manuscript: Who is your audience?

Which journal?

Exercise: Who is your audience?

- **Single discipline?**
- **Multiple disciplines?**

Scribble down the answer

Exercise: Name the audience

- **Write your intended target journal**
- **If you have no answer, what information do you need to answer the question?**

Let's think about publishing

This helps you think about shaping the writing

Choice of journals

- **Who wants/needs to know about your discoveries?**
  Testing the waters for general interest publications?
- **Do you have a short story, a long story, or multiple stories to tell?**
- **How urgent is your need to have the work published?**
- **Is your report principally a replication of previous findings or a failure to do so?**

In choosing the journal, look at the…

- "Scope" section of the journal
- Articles from several recent issues, paying attention to whether they have papers on your topic
- Editorial board or reviewer list

Scope statements from different journals

E. g. compare *Scope* statement from

PLoS Genetics, Journal of Parasitology

Scope of PLoS Genetics

PLOS Genetics **publishes human studies, as well as research on model organisms—from mice and flies, to plants and bacteria. Our emphasis is on studies of broad interest that provide significant insight into a biological process or processes. Topics include (but are not limited to) gene discovery and function, population genetics, {etc.}…epigenetics.**

Scope of Journal of Parasitology

The Journal of Parasitology **{….} Articles {…} range from behavior to pathogenesis to systematics. Contributors enjoy rapid turn-around time and broad exposure as over 1400 libraries world-wide subscribe to the Journal. The Journal is recognized for publishing papers that have a long-term impact on the field of Parasitology.**

Nothing mentioned about process or mechanism

To find a good-fit journal

Look at *Scope statement* early in the process of organizing your manuscript

Each manuscript
is part of
your professional portfolio

Start thinking "Big picture"

When you start to plan a manuscript, ask yourself…

Is the manuscript

- **the start of a new area of research?**
- **a stand-alone paper or the end of a project?**
- **in a discipline that knows you well?**
- **a short story, a long one, or even two separate, related ones?**
- **a story at all? Or is it too early… or too late… to publish it well?**

How does the manuscript fit into your career advancement

- **Do you need a high-profile publication?**
- **Do you need some number of solid publications?**

Questions or comments??

Writing the Paper

- **Rough draft abstract**
- **Results (based on figures, tables, graphics)**
- **Introduction**
- **Discussion**
- **Methods and Materials (from detailed notes all along)**
- **Revised Abstract**

Organizing the Results section

Easy task…

if the work was done by
just one person
in a linear fashion

But how do you tell the story when results come from several researchers, often working in parallel?

Make an outline to help uncover the story

Why do you need an outline?

To organize and prioritized the parts of the project

so that the written document can tell a linear story

In fact…

Outline each part of the manuscript, starting with Results

Outlining the Article

If traditional outlining feels like torture, try mind-mapping….

(See Mind-mapping in my PDF on Slack)

Organizing the Results section of experimental papers

Write one sentence summarizing the results of each figure, table, and graph in the story.

Organize Results section using the "story" from your draft Abstract

Inspect figures, tables and graphs for thematic groups

Write one caption per group.

(Caption: Question that was answered by the findings in that group and the answer revealed by the results in that group.)

Summarize results of each section in a simple sentence using an active verb

Sample Results:

- **Section 1 caption (Question posed? Answer revealed)**
  - **Figure 1 Caption**
  - **Figure 2 Caption**
  - **Summary of results from Section 1**
- **Section 2 caption (Question posed? Answer revealed)**
  - **Table 1**
  - **Graph 1**
  - **Summary of results from Section 2**

ETC., ETC.

Does the manuscript have studies that build one on another, *as well as* experiments done in parallel?

If so, to organize the Results, try "mind-mapping" of figure legends

Once you have a Results outline,

make sure it fits with the Scope of the target journal

Now that you have a Results outline

It’s time to outline **Introduction**

The Introduction

The Introduction should consider…

What question(s) are you posing in this paper?

What controversy in the field or other rationale caused you to pose the question?

What makes the question important, novel and/or significant?

Who wants to know the answer(s)?

Set the order of subtopics in Introduction. Keep same order in Results and Discussion

E.g., discuss genetics, then cell bio, then whole animal concepts

Because the reader anticipates this organization

Mention any results in Introduction?

Many articles do this

Look at examples from the target journal

The Discussion

Based on Introduction and Results (i. e. the questions and the answers),

draft an outline of the Discussion

Possible items for the Discussion

What can you conclude from your individual findings?

What can you conclude from your findings taken together?

What can you conclude from your findings taken in conjunction with other published work?

How do these findings answer the question(s) posed in the Introduction?

Possible items for the Discussion (continued)

What makes these findings novel and/or significant?

What previous work supports your new findings?

What controversy does your work resolve?

Possible items for the Discussion (continued)

What ideas do your new findings argue against/overturn?

- **For controversial findings, how can you defend them, based on your work and/or findings from others?**

What new questions are raised by your findings?

Outline of the manuscript

Completed outline = framework on which to start building your text

Outline should have enough detail for collaborators to understand how you are building your story

Outline can reveal gaps that need filling before manuscript can be finished

Discuss the outline with all authors on the team

Finally, it's time to write!

*Writing the sh***y first draft*

Send your inner editor out to run an errand.

Don't let them back in until a draft is done.

Recall my instruction about Objective, Message, Audience

Set aside those instructions and write for yourself

Otherwise, you may never get the first draft done

Once the first draft is done

- **Invite back your internal editor**
  - **Listen when they remind you to make clear about**
    - **your objective**
    - **your message**
    - **your audience**

Share the draft with mentor, co-authors

- **To get their creative additions/changes**
- **To verify information in their own areas of specialization**
- **To identify parts that lack clarity, are poorly organized**

Share the draft with other people outside your field

- **Look for areas of murkiness, discontinuity, poor organization**
- **Seek suggestions on persuasiveness of tone**

Final Writing Tip

Proofread, proofread, proofread!!!!

- **Better yet, proofread and edit for each other**

You've heard from me

Now you can hear from ChatGPT

ChatGPT topics

- **Provide an introduction and overview of a seminar on effective writing for biomedical scientists**
- **Some common mistakes that scientists make when writing research papers include**
- **Why is science writing often difficult to understand?**

Biggest mistakes scientists make when writing papers to describe their research findings

4 / 4

1. Not clearly defining the problem or research question.
2. Not adequately reviewing the literature and not citing relevant studies.
3. Overstating or exaggerating the significance of the results.
4. Not properly controlling for confounding variables or not adequately reporting on limitations.
5. Not presenting results in an appropriate and easily understandable format.
6. Not including sufficient data and methods to allow for replication of the study.
7. Not considering ethical issues and potential conflicts of interest.
8. Not considering the broader implications and potential real-world applications of the findings.