

*Scientific and Medical Communication:
A Guide for Effective Practice*

Teacher's Guide

2018 Version

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Contents

1. Introduction
2. Overview of the book
 - 2.1 Concept of the book
 - 2.2 Intended audience
 - 2.3 Organization of the book
3. Lectures and discussions
 - 3.1 Overview
 - 3.2 Lecture and discussion course materials
 - 3.2.1 Presentation overview and permissions
 - 3.2.2 Description of resources available to students
4. The assignments
 - 4.1 Discussion questions and practice exercises
 - 4.1.1 Chapter 1: Effective Communication in Science and Medicine
 - 4.1.2 Chapter 2: Scope, Genres, and Audiences of SMC
 - 4.1.3 Chapter 3: Searching and Citing the Scientific and Medical Literature
 - 4.1.4 Chapter 4: Searching and Citing the Scientific and Medical Literature
 - 4.1.5 Chapter 5: Introduction Section
 - 4.1.6 Chapter 6: Methods Section
 - 4.1.7 Chapter 7: The Results Section and Effective Presentation of Data
 - 4.1.8 Chapter 8: The Discussion Section
 - 4.1.9 Chapter 9: Summary Sections: Titles and Abstracts
 - 4.1.10 Chapter 10: Preparing a Manuscript for Submission: Cover Letters, Publication Ethics, and the Peer Review Process
 - 4.1.11 Chapter 11: Introduction to Conferences and Meetings
 - 4.1.12 Chapter 12: Creating Scientific Posters
 - 4.1.13 Chapter 13: Public Communication Strategy and Ethics
 - 4.1.14 Chapter 14: Writing Press (News) Releases
 - 4.2 Major writing assignments
 - 4.2.1 Section 2: IMRAD journal article
 - 4.2.2 Section 3: Scientific poster
 - 4.2.3 Section 4: Press release

References

- Appendix A: Sample Syllabus for a Course in Scientific and Medical Writing
Appendix B: Research Worksheet (Handout)
Appendix C: Record of Database Searches (Handout)

1. Introduction

This is the Teacher's Guide for the following book:

Title: *Scientific and Medical Communication: A Guide for Effective Practice*

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Request an Instructor Review Copy at:

<https://www.routledge.com/resources/compcopy/9781138842557>

Information:

This guide contains the guidelines and (references to) the material to build a complete academic course around the book. The contents of this guide are based on more than a decade of developing scientific communication textbook and instructional materials. This text develops from researching scientific communication pedagogy, teaching graduate-level scientific communication for technical communicators at Clemson and Texas State University, and teaching advanced-undergraduate scientific communication courses. The instructional materials that I have accumulated and I am using as a foundation for this text has been field tested and refined each semester in numerous advanced-undergraduate and graduate scientific writing courses. Additionally, this text is grounded in hundreds of research articles and perspectives from scientists and physicians published in the fields of technical communication, rhetoric, linguistics, and scientific and medical communication.

The structure of this guide is as follows:

- Section 2 contains an explanation of *Scientific and Medical Communication: A Guide for Effective Practice*. It explains the concept behind and the aim of the book, the intended audience for the book, and the structure of the book.
- Section 3 presents a series of lecture and discussion materials that can be used to teach the contents of the book. This section explains the structure of the lectures, the mapping of this structure to the structure of the book, and the available teaching materials.
- Section 4 presents assignments that can be used to strengthen and apply the concepts covered in the book. The structure and aim of the assignments are discussed.

2. Overview of the book

Below, we first explain the concept of the book that is the basis for the course. Then, we discuss the intended audience for the book. In Section 2.3, the structure of the book is explained in terms of its chapters and additional elements.

2.1 Concept of the book

Scientific and Medical Communication: A Guide for Effective Practice provides a comprehensive, research-based guide for scientific and medical communication that is significantly different from other texts.

In general, other scientific and medical communication books have been criticized in the technical communication literature because these books are “based on the necessarily limited professional experience of the authors, their personal opinions and pet peeves, and on occasion, misinformation” (Harmon and Gross 1996, 61). Most other scientific and medical communication books cover the same limited content contained in style manuals and lack adequate examples of organization and style to adequately prepare readers to be effective members in professional discourse communities. Moreover, other texts use highly technical examples that are too complex for most novice science and medical students as well as technical writers so that book is not adequate for this audience.

The primary objective of *Scientific and Medical Communications: A Guide for Technical Communicators* is to prepare readers to:

- Write and edit scientific papers, posters, and presentations according to journal and professional standards,
- Research the scientific and medical literature,
- Compile and organize data and statistics to develop a persuasive and scientifically grounded argument,
- Design and prepare figures and tables for publication, and
- Serve as a liaison between scientists and publishers to facilitate submissions of journal articles and conference abstracts/materials.

Key features:

- Authored by a trained scientist and technical communicator who has written all of the genres covered in the text (scientific and medical journal articles, scientific posters, scientific abstracts, and press/news releases),
- Annotated real-world examples show the points covered in the text,
- Real-world examples are carefully selected so that the content can be understood by writers without a background in science or medicine, and
- Thoroughly discusses scientific writing style so that writers can make informed decisions.

This book is firmly grounded in research findings published in the fields of technical communication, rhetoric, linguistics, and medical communication, as well as commentaries published in the scientific literature.

2.2 Intended audience

The primary audiences for *Scientific and Medical Communications: A Guide for Technical Communicators* are novice science and medical students, technical communicators, and medical writers. Students are expected to have fundamental college-level writing skills.

Primary audiences:

- Students in upper-division undergraduate or graduate-level courses in scientific and medical communication (these courses are included in both English departments, science departments, and sometimes communication departments; thus the students may be in English/technical communication or science),
- Technical writers or scientists in industry wanting to become medical writers (or scientific writers), and
- Graduate students in science or medicine.

The book has been developed primarily to be use in:

- Upper-division undergraduate or graduate-level courses in scientific and medical communication;
- As a supplement in research methods courses,
- Workshops in industry, academic, and government settings; and
- Professional training courses, particularly in industry.

2.3 Organization of the book

First the book covers the highlighting the content and organization of SMC and covers researching and citing the scientific and medical literature. Following this foundation section, this text examines the genres of scientific and medical research, which includes writing journal articles (section II), communicating research at conferences (section III), and sharing research results with the public and news media (section IV). In each section, this text examines the prototypical genre and discusses the approach that students should take to be an effective communicator within a scientific or medical discourse community. Within each chapter, this text also examines the issues of the scientific writing style that are relevant to the genre and practices of professional and ethical communication so that readers will make informed decisions about their communications.

The book is organized so that students can read the introduction chapter to each genre and then focus on writing one specific section at a time. When writing journal articles and conference posters (or presentations), students should read the chapter in section II that

corresponds to the appropriate IMRAD (Introduction, Methods, Results, and Discussion) section of their communication.

3. Lectures and discussions

In this section, we discuss a series of lectures that can be used to teach the contents of the book discussed in the previous section. This is ‘a’ series of lectures and not ‘the’ series of lectures, as the book can be used for more compressed or more elaborate courses. The presented series is based on ample experience with teaching this course.

Below, we first present the structure of this series of lectures. Then, we discuss classroom material available.

3.1 Overview

The lecture series contains 14 lectures. Each lecture corresponds to a chapter in the text.

The lectures that are available include:

1. Chapter 1: Effective Communication in Science and Medicine
2. Chapter 2: Scope, Genres, and Audiences of SMC
3. Chapter 3: Searching and Citing the Scientific and Medical Literature
4. Chapter 4: Communicating Research in Primary Journals
5. Chapter 5: The Introduction Section
6. Chapter 6: The Methods Section
7. Chapter 7: The Results Section and Effective Presentation of Data
8. Chapter 8: The Discussion Section
9. Chapter 9: Summary Sections: Titles and Abstracts
10. Chapter 10: Preparing a Manuscript for Submission: Cover Letters, Publication Ethics, and the Peer Review Process
11. Chapter 11: Introduction to Scientific Conferences
12. Chapter 12: Creating Scientific Posters
13. Chapter 13: Public Communication Strategy and Ethics
14. Chapter 14: Writing Press (News) Releases

3.2 Lecture and discussion course materials

3.2.1 Presentation overview and permissions

For each lecture as discussed in the previous subsection, a slide set is available in the Website for the book. The format of the slide sets is Microsoft PowerPoint. The slide sets are closely aligned with the contents of the book.

Users of the book are allowed to modify and/or extend the slide sets under the condition that the copyright notice at the bottom of the slides remains intact.

3.2.2 Description of resources available to students

The student section of the website is organized by chapter and provides the following content freely available on the Web:

- Summary: A brief overview of the chapter content
- Questions: Extensive list of discussion and analysis exercises to reinforce and apply the concepts presented in each chapter
- Flashcards: A self-study tool for students to review the key terms in each chapter
- Links: Hyperlinks to additional resources on the Web, which includes further reading, video, and tool (available for most chapters)

4. The assignments

Two types of practical assignments are available to be used in the course:

- Discussion questions and practice exercises, which provide the basis for mastering the material in each chapter (these questions and exercises are freely available to students on the Students section of the website); and
- Major writing assignments, which are larger assignments that represent real-world scientific and medical communication projects and require students to synthesize the material in each unit. These writing assignments are organized by genre and correspond to sections 2, 3, and 4 of the text. The major writing assignments are described below.

Users of the book are allowed to use, modify, and/or extend these assignments.

4.1 Discussion questions and practice exercises

In the following subsections, discussion questions and practice exercises are provided for each chapter. Each subsection includes the resources posted to the student section of the website, including the list of terms and definitions available to students as flashcards and links.

4.1.1 Chapter 1: Effective Communication in Science and Medicine

Summary

This chapter provides an introduction to scientific and medical communication by examining the characteristics of effective (and ineffective) communication in science and medicine and expectations of effective communicators. In addition this chapter examines the roles of researchers and professional communicators in science and medicine. This chapter also defines the unique requirements for authorship in science and medicine.

Flashcards

Term	Definition
authors	Those who make substantial scientific contribution to the research
writers	Those who contributed to the writing of a scientific or medical paper
principle investigator	The lead researcher of a research team
corresponding author	The individual that serves as the primary contact with the journal editor during the manuscript submission, peer review, and publication process

Questions

1. “Science” and “medicine” are terms that we have heard since grade school and are often used in the news media. But what do these words mean and imply? Examine each term and note what comes to mind as: (a) culturally (in Western society) and (b) personally to you. Then look up the terms in a dictionary. How does the dictionary definition of science and medicine compare to your definition?
2. What part(s) of the dictionary definition of science is/are important for communicators?
3. In figure 1.1, the LEX scores for *Science* and *Nature* have increased from 1900 to 2000. (a) What are some reasons that could explain the increase in LEX scores? (b) Is the increase in LEX scores entirely the result of increasingly poor writing? Why or why not?
4. In 1967, Woodford stated, “I believe that we can strengthen scientific thinking by teaching scientific writing.” In your own opinion, how can scientific writing contribute to scientific thinking?
5. How is a scientific or medical journal article similar to a legal case?
6. Can you reduce effective communication to simple grammatical rules such as “never use passive voice” or “never split an infinitive”? Why or why not?
7. What are characteristics of effective writing and communication? (First list the characteristics and then rank them in order of importance.)
8. The terms “authors” and “editors” are used differently in SMC than in conventional practice.
9. What are the requirements to qualify as an author of a scientific paper (according to the criteria provided by the American Psychological Association and International Committee of Medical Journal Editors)? How are the criteria similar and different?
10. What are contributions that scientific and medical writers make to SMC?
11. Are professional writers (such as medical writers or technical communicators) listed as an author in SMC? If not, how would their contribution be noted?
12. All professional writers should expect to become technical experts on specific topics. How does a technical communicator or medical writer become a technical expert on SMC?

Links

Sounder Thinking Through Clearer Writing

<http://www.sciencemag.org/content/156/3776/743.long>

Scientific Literacy: Clear as Mud

<http://www.nature.com/nature/journal/v423/n6938/full/423376a.html>

European Medical Writers Association (EMWA) Guidelines On The Role Of Medical Writers in Developing Peer-Reviewed Publications

http://www.emwa.org/documents/about_us/EMWAGuidelines.pdf

Career Pathways in Medical Communication
http://www.amwacarolinas.org/files/betterton-lewis_2007_career%20pathways.pdf

Starting Out as a Medical Writer: How to Generate Writing Samples
<http://connection.ebscohost.com/c/articles/20552829/starting-out-as-medical-writer-how-generate-writing-samples>

4.1.2 Chapter 2: Scope, Genres, and Audiences of SMC

Summary

This chapter examines the important role of communication in science and medicine, and how communication is an essential stage of scientific research. This chapter applies communication principles to the field of scientific and medical discourse. Specifically the field of scientific and medical communication are defined and distinguished from science and health care communication. This chapter describes the scope, genres, and audiences of scientific and medical communication.

Flashcards

Term	Definition
scientific communication	Communication of scientific information to a highly technical expert audience of researchers studying closely related topics those who make substantial scientific contribution to the research
scientific information	Knowledge that arises from systematic observation or experimentation
scientific method	systematic process of observation or experimentation that yields scientific knowledge
medical communication	subset of scientific communication that encompasses clinically relevant research findings to audiences for research or application to therapy
science communication	dissemination of scientific research findings to general audiences
health communication	dissemination of medical research findings to general audiences
genre	standardized types or categories of communication that have specific content, organization, and style
primary sources	original source of research findings
secondary sources	genres that are not the first reports of scientific findings
audience	intended recipients of a communication
primary audience	main group of individuals who are the intended recipients or target of a particular communication genre
secondary audiences	groups other than the primary audience who might also read a genre but for a different purpose
gatekeepers	individuals who may prevent a communication from reaching the primary audience

discourse community	group of researchers who study the same, highly focused research topic and formally share research findings
paradigm	a common understanding of the process, function, or model of a particular scientific or medical issue
hypothesis	putative outcome of an untested research question
theory	findings from published research papers

Questions

1. How does scientific publication benefits science and/or the scientific community?
2. How does scientific publication benefit scientists?
3. What distinguishes scientific and medical communication from other forms of communication?
4. What is the difference between scientific communication and science communication?
5. Define the term “genre.” What are some common types of genres? How do genres help writers and readers?
6. What are the major genres in SMC? What is the content of each genre?
7. Examine each of the SMC below. (a) Identify the genre. (b) Develop a list of the major characteristics (or features) of each genre. Note: To identify the relevant features, you should compare each document/genre to the others. You should look for anything that is characteristics of the genre, such as length, writing style, organization, and references. You may have to skim the documents but you should not have to read them completely.
 - a. [http://www.maturitas.org/article/S0378-5122\(13\)00047-9/pdf](http://www.maturitas.org/article/S0378-5122(13)00047-9/pdf)
 - b. <http://jnci.oxfordjournals.org/content/107/2/dju421.full.pdf>
 - c. <http://www.nature.com/nature/dna50/watsoncrick.pdf>
 - d. <http://www.bmj.com/content/bmj/347/bmj.f3757.full.pdf>
8. What are primary sources? How do they differ from secondary sources? In question 7, which genres are primary sources and which are secondary sources?
9. Define the terms “primary audience,” “secondary audience,” and “gatekeeper.” Provide an example of each in SMC.
10. How do audiences read SMC?
11. Although the audiences of scientific communication genres appear to be very similar, how do they differ? How will these differences influence your writing?
12. As shown in figure 2.2, scientific communication audiences can be plotted along a continuum of laboratory (or research) experience and specific technical knowledge. Where would you place physicians on this chart?
13. How does the reading pattern of scientists differ from that of physicians
14. Define the term “discourse communities.” Identify the discourse community of each article in question 7. What are the general strategies that you used to determine the discourse community?
15. What is a paradigm? Provide an example of a paradigm. How will paradigms influence your writing in SMC?

16. What are the steps of the scientific method? How does communication fit into the scientific method?
17. Review the dictionary definition of “science.” What words or terms are used differently in communications among scientists and communications for the general public?
18. How are the terms “hypothesis” and “theory” used in SMC? Provide an example of each.
19. Read the Abstract of the journal article from question 7a and highlight the hedging words or statements.

Links

Publish or Perish

<http://bioscience.oxfordjournals.org/content/55/5/390.full>

Scientific Writing & the Scientific Method: Parallel “Hourglass” Structure in Form & Content

http://www.nabt.org/websites/institution/File/pdfs/american_biology_teacher/2003/065-08-0591.pdf

A Call for New Courses to Train Scientists as Effective Communicators in Contemporary Government and Business Settings

<http://www.ingentaconnect.com/content/stc/tc/2008/00000055/00000004/art00005>

4.1.3 Chapter 3: Searching and Citing the Scientific and Medical Literature

Summary

This chapter guides readers through the process of performing a comprehensive literature search of research articles in science and medicine. In particular, this chapter covers selecting an appropriate database for research topic, identifying effective keywords to yield a manageable list of database records, using Boolean operators to broaden or limit the database results, and accessing the full text of scientific and medical journal articles. This chapter also guides readers through the process of using key articles to find other highly relevant research. Readers also learn the professional management of database search parameters to efficiently and effectively maintain a comprehensive, up-to-date library of scientific and medical journal articles. An introduction to reference management software is provided. In addition, this chapter discusses the process for checking of corrections and retractions of the scientific research. This chapter includes an examination the problems of miscitation (or improper citation), citation manipulation, and “random” citing in science and medicine. Finally, this chapter concludes with a discussion of proper citation practices.

Flashcards

Term	Definition
information foraging	Process of conducting a literature search by which one conducts series of database searches that provides new leads and possible paths to follow to find the necessary information
journal articles	refereed articles of original research
review articles	comprehensive summaries of original research journal articles
literature reviews	comprehensive summaries of original research journal articles
grey literature	category of technical and semitechnical work that was not evaluated by a comprehensive peer-review process
top database	database of SMC literature with the most records for a particular topic
database hosts	database interfaces
database index	collection of records or articles contained in the database
Boolean operators	words (such as AND, OR, or NOT) used to refine a database search
Medical Subject Headings (MeSH)	controlled list of terms that are labels used to categorize biomedical articles
index terms	controlled vocabulary of labels used to categorize articles in databases
open access	free access to content
key articles	highly relevant journal articles of original research or literature reviews
citation tracking	uses the list of references in an article to find other highly relevant articles
forward tracking	database search for newer articles that cite a key article
digital object identifier (DOI)	unique identification number assigned to digital publications such as individual journal articles
miscitation	improper quotation of information from other sources or bibliographic information
misquotation	an inaccurate or misleading statement in the text of an article that fails to properly convey the information from the original source
major error (misquotation)	a claim is unsubstantiated by, unrelated to, or contradicted by the referenced article
minor error (misquotation)	when a claim is inaccurate but does not change the overall meaning of the referenced article
bibliographic errors	mistakes made in the reference information
orphan references	a type of bibliographic error in which the citation appears in a paper but is not included in the reference list or vice versa
empty referencing	Inappropriate citation of a secondary source for data rather than the original research journal article
lazy author syndrome	Practice of empty referencing: Inappropriate citation of a secondary source for data rather than the original research

	journal article
citation manipulation (or "citation gaming")	inappropriate citation of sources for the sole purpose of increasing the citation counts of those sources
self citation	citing one's own work (may be a form of citation manipulation)
citation swapping	exchange citations among colleagues (often a form of citation manipulation)
model of random-citing scientists	illustrates that scientists are biased to citing articles that were cited in recent articles
sleeping beauty	journal articles that are relatively unnoticed for a period of time and then gather significant citations

Questions

1. What sources of information is cited in SMC? What sources of information is not cited in SMC? What is the reason for the difference?
2. What is the difference between plagiarism and self-plagiarism? Why is self-plagiarism unethical in SMC?
3. In SMC, when should paraphrase and when should you directly quote another article?
4. What is the DOI? Where do you find it? How is it used?
5. When should you cite information from a review article? How should the information be introduced in your text?
6. What is the difference between citation tracking, forward tracking, and related articles? When would you use each approach?
7. What is the difference between MEDLINE and PubMed? Explain your answer.
8. You want to find information about the effects of global warming on agriculture. (a) Which database(s) would you search? (b) Should you search more than one database? Why or why not? (d) What keywords would you use to search databases? (e) How could you use Boolean operators to focus your search? Note: Use the table in example 3.4, the Record of Databases Searches, to record your results. A blank copy of this table is available in the document section of the student website.
9. Using PubMed (<http://www.ncbi.nlm.nih.gov/pubmed>), obtain a PDF of the following journal article:

Blaustein, Andrew R., Joseph M. Kiesecker, Douglas, P. Chivers, and Robert G. Anthony. 1997. "Ambient UV-B Radiation Causes Deformities in Amphibian Embryos." *Proceedings of the National Academy of Sciences*, 94: 13735–7.

Note: The database record will have links to the complete article (available as HTML and PDF). Be sure that you access the entire article and not simply the abstract provided by the database.
10. You want to find the latest research on the measles vaccination and autism. (a) Which databases would you search? (b) What keywords would you use to search databases? (c) How could you change the specificity of keywords to expand your search to find more articles? Note: Use the table in example 3.4, the Record of

- Databases Searches, to record your results. A blank copy of this table is available in the document section of the student website.
11. Find the most recent and relevant research articles on the measles vaccination and autism. (a) Find and download a PDF of a journal article of original research. (b) Read the journal article you found and complete the Research Worksheet available in the student section of the website. (c) Find and download a PDF of a recent review article.
 12. Evaluate the articles that cite the Blaustein et al. (1997) article in question 9. (a) Find the total number of articles that cite the article in PubMed and Google Scholar. (b) Determine the number of related citations in each database. (c) Are the numbers of citations the same or different? If the numbers of citations are different, explain why. Note: Use the table in example 3.4, the Record of Databases Searches, to record your results. A blank copy of this table is available in the document section of the student website.
 13. Using the PDF of the Blaustein et al. (1997) article that you accessed in question 9 to identify five keywords for searching databases. To identify the best keywords, you will need to read the entire paper. As you read the paper, underline or highlight the following: (a) the research question, hypothesis, or purpose of the study, and (b) the major findings of the paper. Then to answer the question about keywords: (c) list the top 5 specific terms that will be useful in a database search to find related articles. (For this question, do not use author names as keywords.)
 14. Visit the journal's website for the Blaustein et al. (1997) article in question 9. (a) Find the Blaustein et al. (1997) article in the journal's archive. (b) Identify the indexed terms for the article. (c) Compare the index terms to the keywords you identified in question 13: Are the keywords that you selected the same or different than the indexed terms? (d) How would your search results vary if you used the indexed terms in a database search? (e) How are the indexed terms useful?
 15. Using the databases listed in table 3.1, (a) what would be the best database to use to search for other papers on the topic in question 3? (b) Use Boolean operators to plan your search strategy. List three searches that include Boolean operators.
 16. Check your answer in question 15 by finding the number of related citations (or related articles) to the Blaustein et al. (1997) article in question 9. To answer this question, you should find the database record for Blaustein et al. (1997) article and then find the number of related citations in five databases. Construct a list of the number of related citations for each database in table 3.1. Note: Use the table in example 3.4, the Record of Databases Searches, to record your results. A blank copy of this table is available in the document section of the student website.
 17. Conduct a database search to locate review articles relevant to the Blaustein et al. (1997) article in question 9. Describe and record how you found review articles on the topic: (a) Which databases did you use? (b) What was your search strategy? (c) What decisions did you have to make during the search process? (d) How did you decide when your literature search was exhaustive? (e) What general recommendations can you make to find review articles on other topics?
 18. What are Medical Subject Headings (MeSH)? Use them to find biomedical papers relevant to the Blaustein et al. (1997) article in question 9. Describe your process and list the papers you identified. Note: Use the table in example 3.4, the Record

of Databases Searches, to record your results. A blank copy of this table is available in the document section of the student website.

19. Determine a strategy to receive automated updates for the Blaustein et al. (1997) article in question 9. (a) Identify three different automated updates. Visit the website for each source and describe how to register and configure each update. (b) Will your automated updates completely replace the need to conduct manual searches? Why or why not?
20. What is citation manipulation? Why is it unethical? What are the guidelines for ethical citation?
21. In this chapter we described a laboratory legend regarding miscitation. Briefly, a literature review paper incorrectly reported the growth rate of *Shigella* in the intestine. Refer to this example and compare to the types of miscitation in figure 3.10. What type of miscitation was the example of *Shigella* growth rate?
22. What is open access? For journal articles that are not open access, what are different ways that you can get the complete text?

Links

PubMed Instructions

<http://www.ncbi.nlm.nih.gov/books/NBK3827/>

The DOI System

<http://www.doi.org/>

Popular Reference Management Software

- EndNote: <http://endnote.com/>
- RefWorks: <https://www.refworks.com/>

Free Reference Management Software

- Citeulike: <http://www.citeulike.org/>
- Docear: <http://www.docear.org/>

4.1.4 Chapter 4: Searching and Citing the Scientific and Medical Literature

Summary

This chapter introduces readers to scientific and medical journal articles of original research. This chapter provides readers with a stepwise approach to preparing to write a journal article of original research once the data from the research experiments are collected. Specific issues covered include selecting a target journal based on the audience, scope, prestige, and impact factor. The chapter introduces the Instructions to Authors and shows readers where to find this information and how to use it to define the style and format of the manuscript. The major style manuals in scientific and medical communication are also included along with a description of how to use a style manual along with the Instructions to Authors. This chapter also introduces the standard format

of an article of original research (the IMRAD organization), which establishes the organization for the following chapters in section II.

Flashcards

Term	Definition
data set	results from a single experiment
manuscript	specific genre that communicates research between a research team and the journal editors and reviewers
target journal	the single journal where authors plan to submit a research manuscript
Instructions to Authors	style and submission guidelines for a journal
broad top of the heap journal	publishes cutting-edge research on “hot” topics that defines or shifts the current paradigm in a field and is of interest to a broad scientific audience
near the top journal	also publishes cutting-edge research within a more specific area and provides more depth than broad top of the heap journals
society level journal	publishes research on broader topics usually by members of a professional society
specialty or subspecialty journal	publishes in-depth research on a niche topic
acceptance rate	the percent of papers accepted to a journal out of total submissions
impact factor	metric used to compare journals within a field--the average number of times that each article in a journal is cited over a two-year period
article processing charges	fees charged to the authors of research to publish an article
prepress publication	article available on a website prior to release of the print journal
fast track	accelerate the review of cutting-edge research
journal articles	Reports of original research from experimental, observational, or theoretical studies or the development of new laboratory methods
brief reports (letters or notes)	Shorter reports of original research
case studies (or clinical observations)	Original research that provides a descriptive account of a single individual or example
editorials or commentaries	Opinion pieces written by researchers to comment on other research published in the journal
IMRAD	Acronym stands for the major sections of a journal article (INTRODUCTION, METHODS, RESULTS, and DISCUSSION)
style manuals	provide a set of disciplinary norms that are accepted by many journals within a particular field

Questions

1. What are the major sections of the journal article? What is content is included each section?
2. How does the formalized IMRAD organization help authors?
3. How does the formalized IMRAD organization help readers? Provide two different examples of how different readers would benefit from the organization in different contexts.
4. What does it mean to “tell a story” in a journal article? How does each section of the IMRAD organization contribute to the story?
5. How does the organization of journal articles resemble an hourglass? Draw an hourglass and show where each section of the IMRAD organization would change.
6. How is the structure of the IMRAD journal article similar to the scientific method? Where would the steps of the scientific method fit into the scientific article?
7. What is a target journal? What criteria should be used to select a target journal?
8. (a) Identify a specialty or subspecialty target journal for the following research article:

Blaustein, Andrew R., Joseph M. Kiesecker, Douglas, P. Chivers, and Robert G. Anthony. 1997. “Ambient UV-B Radiation Causes Deformities in Amphibian Embryos.” *Proceedings of the National Academy of Sciences*, 94: 13735–7.

(b) Describe your rationale for selecting the target journal.
9. Locate the Instructions to Authors for the target journal that you identified in question 8. Revise the reference in question 8 into the appropriate format for the target journal.
10. What is does an impact factor measure? Is a higher or lower number better? How does the impact factor guide selection of a target journal?
11. What are the pros and cons of using an impact factor measurement to select journals?
12. Find the impact factor of the journal in question 8 and the target journal you identified in question 9. How does the impact factors compare?
13. Read the *Nature* paper by Watson and Crick (1953) on the “Molecular Structure of Nucleic Acids” (available at: <http://www.nature.com/nature/dna50/watsoncrick.pdf>) and label each part of the IMRAD structure.
14. (a) What information do style guides provide? (b) What information do Instructions to Authors provide? (c) Compare and contrast style guides to Instructions to Authors. (d) If a style guide and Instructions to Authors conflict in style recommendation, which would you use? Why?
15. Find the Instructions for Authors for the journal *Science*. Examine the formatting requirements for manuscripts submitted to the journal. Next, examine a research article from the journal. How does the manuscript differ from the journal article?

Links

Major style manuals in SMC published by organizations.

Organization	Style Manual	URL
American Chemical Society	<i>The ACS Style Guide: Effective Communication of Scientific Information</i>	http://pubs.acs.org/series/styleguide
American Medical Association	<i>AMA Manual of Style: A Guide for Authors and Editors</i>	http://www.amamanualofstyle.com
American Psychological Association	<i>Publication Manual of the American Psychological Association</i>	http://www.apastyle.org
Council of Science Editors	<i>Scientific Style and Format: The CSE Manual for Authors, Editors, and Publishers</i>	http://www.scientificstyleandformat.org
International Committee of Medical Journal Editors	<i>Recommendations for the Conduct, Reporting, Editing and Publication of Scholarly Work in Medical Journals</i> (previously the <i>Uniform Requirements for Manuscripts</i>)	http://www.icmje.org/recommendations

4.1.5 Chapter 5: Introduction Section

Summary

In this chapter, readers will learn to select and organize content to present for the Introduction section. The “Create a Research Space” (CARS) model is examined in detail and shown in context of 18 annotated examples from the scientific and medical literature. The chapter also examines the subtle differences in the Introductions for experimental (or hypothesis) testing and exploratory investigations as well as the differences between quantitative and qualitative research. This chapter also covers scientific writing style and specifically addresses issues and errors common in the Introduction section. A discussion of scientific writing issues and real-world examples are included for verb tense, flow (or continuity of information), passive and active voice, technical terms and jargon, and scientific nomenclature, abbreviations, and acronyms.

Flashcards

Term	Definition
Create a Research Space (or CARS) model	Organization of content in the Introduction section
Move 1	Establishing a research territory

Move 1-Step 1	Establishing the importance of the research topic
Move 1-Step 2	Summarizing previous research to contextualize the present study
Move 2	Justifying the present study by identifying a gap or inconsistency in the literature, which establishes a niche for the present research
Move 3	Stating the objective of the present research (to fill the research niche).
experimental (or hypothesis-) testing	conventional view of scientific research in which researchers examine cause-and-effect relationships between two variables
exploratory investigation	research with more general (or exploratory) goals that cannot be converted into testable hypotheses
quantitative research	data are quantitative or numerical measurements
qualitative research	data are descriptive
hypothesis	a formal statement that provides the researcher's prediction about the outcome of an experimental test
testable	subject to experimentation
falsifiable	able to be disproven by the outcome of research
variables	events or conditions that can be observed and measured
independent variable	treatment or condition that is adjusted by the researchers
dependent variable	the outcome or effect monitored for change
population	the group being examined in the research
null hypothesis	states there is no relationship between the variables
alternative hypothesis	accounts for the opposite outcome of the hypothesis
indicative summaries	include the (1) purpose and (2) methods and scope of the research
informative summaries	include information that corresponds to the each IMRAD section, the (1) purpose, (2) methods and scope, and (3) the primary findings of the data, and (4) often the value or implications of the research
jargon	a pejorative label that applies when technical terms are misused with an audience that is unfamiliar with the definitions of those terms
binomial	composed of two words
specific epithet	second word of the scientific names of organisms
eponym	the person or place used in the naming of a disease, diagnostic test, or scientific method
acronyms	names formed from the first letter of a longer term and pronounced as a word

Questions

1. Compare and contrast the content of a review article with the Introduction section of a journal article. How are they similar? How are they different?

2. What are the Moves and Steps of the “Create a Research Space” (CARS) model?
3. Read the Introduction from the journal article below. In the Introduction, identify the Moves and Steps of the “Create a Research Space” (CARS) model. Specifically, locate and label the following: (a) Move 1 Step 1, (b) Move 1 Step 2, (c) Move 2, and (d) Move 3.

Virtanen, Marianna, Markus Jokela, Solja T. Nyberg, Ida EH Madsen, Tea Lallukka, Kirsi Ahola, Lars Alfredsson et al. 2015. “Long working hours and alcohol use: systematic review and meta-analysis of published studies and unpublished individual participant data.” *BMJ* 350: g7772. Available at: <http://www.bmj.com/content/350/bmj.g7772>
4. Read the Introduction from the journal article below. In the Introduction, identify the Moves and Steps of the “Create a Research Space” (CARS) model. Specifically, locate and label the following: (a) Move 1 Step 1, (b) Move 1 Step 2, (c) Move 2, and (d) Move 3.

McElroy, Anita K., Bobbie R. Erickson, Timothy D. Flietstra, Pierre E. Rollin, Stuart T. Nichol, Jonathan S. Towner, and Christina F. Spiropoulou. 2014. “Biomarker correlates of survival in pediatric patients with Ebola virus disease.” *Emerging Infectious Diseases* 20 (10): 1683–90. Available at: <http://wwwnc.cdc.gov/eid/article/20/10/pdfs/14-0430.pdf>
5. What are the different strategies that authors use to justify a present study and establish a research niche? Which strategies are used in the Introduction sections in questions 3 and 4?
6. What are the general principles for tense and voice in the Introduction section?
7. Examine the Introduction section in question 3 for verb tense and voice. Highlight the text and note the tense or voice in the margin of the article. How does the tense and voice (active versus passive) change in each section of the CARS model?
8. Examine the Introduction section in question 4 for verb tense and voice. Highlight the text and note the tense or voice in the margin of the article. How does the tense and voice (active versus passive) change in each section of the CARS model? How does this compare to your analysis in question 7? What is/are the reason(s) for the differences?
9. Examine the Introduction section in question 3 for flow and linking statements. First highlight each statement. Then determine if the passage follows the funnel structure. If not, make any necessary edits.
10. What is (or are) the advantage(s) to writing an Introduction section in reverse order (from Move 3 to Move 1)?

4.1.6 Chapter 6: Methods Section

Summary

This chapter begins by discussing the role of the Methods section functionally and rhetorically, and how the content and style of the Methods differs from procedures in laboratory notebooks. In this chapter, the Methods section is subdivided into three general subsections, which are: (1) selection of participants or subjects, (2) investigation procedure, and (3) data analysis. Readers are provided with guidelines for selecting

content and identifying the proper level of detail in each subsection. Multiple examples from the scientific and medical literature are annotated to show how each subsection is written. This chapter also covers scientific writing style and specifically addresses issues and errors common in the Methods section. A review of verb tense, passive versus active voice, and use of personal pronouns is specific for the Methods section.

Flashcards

Term	Definition
laboratory notebook	detailed record of the exact actions performed
participant	humans who have autonomy and freely agreed to be involved in the research
subjects	reserved for animals, plants, bacteria, viruses, and inanimate objects that were exposed to the experimental procedure by the researchers

Questions

1. What is the purpose of the Methods section?
2. What is the content of the Methods section? How much detail should you provide in the Methods section?
3. What are the major subsections of the Methods section? What is the content of each?
4. How will different audiences or subgroups use the content in the Methods section?
5. How is the Methods section different from a set of instructions or protocol?
6. How is the Methods section of top journals (like *Science*) different from more specific, niche journals (like *Emerging Infectious Diseases*)? What differences do you observe? What are the reasons for the differences? In developing your answer, compare the following two articles:
 - a. Shohat-Ophir, G., K. R. Kaun, R. Azanchi, H. Mohammed, and U. Heberlein. 2012. "Sexual deprivation increases ethanol intake in *Drosophila*." *Science* 335 (6074): 1351–5. Available at: <https://www.sciencemag.org/content/335/6074/1351.full.pdf>
 - b. McElroy, Anita K., Bobbie R. Erickson, Timothy D. Flietstra, Pierre E. Rollin, Stuart T. Nichol, Jonathan S. Towner, and Christina F. Spiropoulou. 2014. "Biomarker correlates of survival in pediatric patients with Ebola virus disease." *Emerging Infectious Diseases* 20 (10): 1683–90. Available at: <http://wwwnc.cdc.gov/eid/article/20/10/pdfs/14-0430.pdf>
7. When and how are citations used in the Methods section?
8. Read the Methods from the journal article below. Identify the different types of content: (a) standard procedure, (b) procedure detailed in previous study or a using a commercial product, (c) procedures detailed in previous study with modifications, and (d) substantially modified or new procedures. How much explanation or justification is provided in each case? Explain why.

Blaustein, Andrew R., Joseph M. Kiesecker, Douglas, P. Chivers, and Robert G. Anthony. 1997. "Ambient UV-B Radiation Causes Deformities in Amphibian Embryos." *Proceedings of the National*

Academy of Sciences, 94: 13735–7. Available at:
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC28375/pdf/pq013735.pdf>

9. Compare the use of subheadings within the Methods section in the two articles below. Which subheadings are better? Why?
 - a. Young, Meredith E., Geoffrey R. Norman, and Karin R. Humphreys. 2008. “Medicine in the popular press: The influence of the media on perceptions of disease.” *PLoS One* 3 (10): e3552. Available at: <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0003552>
 - b. Loftfield, Erikka, Neal D. Freedman, Barry I. Graubard, Albert R. Hollenbeck, Fatma M. Shebl, Susan T. Mayne, and Rashmi Sinha. 2015. “Coffee drinking and cutaneous melanoma risk in the NIH-AARP diet and health study.” *Journal of the National Cancer Institute* 107 (2): dju421. Available at: <http://jnci.oxfordjournals.org/content/107/2/dju421.full.pdf+html>
10. How is voice used in the Methods section?
11. What tense is used predominantly in the Methods section? Why?
12. How are first-person pronouns used in the Methods section?
13. Compare use of verb tense, voice, and personal pronouns in the Methods sections from the following articles. Describe your findings.
 - a. Blaustein, Andrew R., Joseph M. Kiesecker, Douglas, P. Chivers, and Robert G. Anthony. 1997. “Ambient UV-B Radiation Causes Deformities in Amphibian Embryos.” *Proceedings of the National Academy of Sciences*, 94: 13735–7. Available at: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC28375/pdf/pq013735.pdf>
 - b. Loftfield, Erikka, Neal D. Freedman, Barry I. Graubard, Albert R. Hollenbeck, Fatma M. Shebl, Susan T. Mayne, and Rashmi Sinha. 2015. “Coffee drinking and cutaneous melanoma risk in the NIH-AARP diet and health study.” *Journal of the National Cancer Institute* 107 (2): dju421. Available at: <http://jnci.oxfordjournals.org/content/107/2/dju421.full.pdf+html>
14. Read the Methods from the journal article below. Revise the Methods section based on the information provided in the text.

Young, Meredith E., Geoffrey R. Norman, and Karin R. Humphreys. 2008. “Medicine in the popular press: The influence of the media on perceptions of disease.” *PLoS One* 3 (10): e3552. Available at: <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0003552>
15. Based on the information provided in the text, reorganize and revise the Methods section of the following article:

Kramer, Adam DI, Jamie E. Guillory, and Jeffrey T. Hancock. 2014. “Experimental evidence of massive-scale emotional contagion through social networks.” *Proceedings of the National Academy of Sciences* 111(24): 8788–90. Text available at: <http://www.pnas.org/content/111/24/8788.full>
16. Based on the information provided in the text, reorganize and revise the Methods section of the following article:

Blaustein, Andrew R., Joseph M. Kiesecker, Douglas, P. Chivers, and Robert G. Anthony. 1997. "Ambient UV-B Radiation Causes Deformities in Amphibian Embryos." *Proceedings of the National Academy of Sciences*, 94: 13735–7. Text available at: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC28375/>

Links

Evolving the Scientific Method
<http://www.the-scientist.com/?articles.view/articleNo/29382/title/Evolving-the-Scientific-Method/>

4.1.7 Chapter 7: The Results Section and Effective Presentation of Data

Summary

This comprehensive chapter discusses organizing and presenting data in the Results section. This chapter shows how the Results sections for experimental (or hypothesis) and exploratory research papers are organized differently. This chapter includes multiple real-world examples that demonstrate the principles of effective data presentation and proper scientific writing style. Additionally, readers are shown how to distinguish major results from minor results and to present data in text and visually (in tables, graphs, or other figures) to clearly show the key information. A discussion of tables tells the reader how to organize and layout data. A discussion of graphs is focused specifically on use in science and medicine. In particular, this discussion tells readers how to select an appropriate graph for the type of data and then provides a detailed discussion on proper graph design. Other forms of data presentation are included, such as a practical summary of statistics, use of photographs and instrument output, designing drawings and diagrams, and using maps.

Flashcards

Term	Definition
empirical	rely on direct observation and data
results	The relevance of the data
data	the raw measurements that are obtained directly from experiments and observations
participants	humans who have autonomy and freely agreed to be involved in the research
subjects	reserved for animals, plants, bacteria, viruses, and inanimate objects that were exposed to the experimental procedure by the researchers
baseline data	relevant demographics and preexperimental characteristics of each participant group
adverse events	harm to participants or unintended effects
boxhead	the top of a table
column	vertical arrangement for content in a table

stub	the left-hand column of a table
row	horizontal arrangement for content in a table
data cell	the intersection of the vertical (column) and horizontal (row) in a table
significant digits	limit to the prevision of measurements
continuous data	data can be of any incremental value
categorical (or discrete) data	data fits into a group
nominal groups	data groups unable to be ordered
ordinal groups	data groups that have an inherent order
bar graphs	data are represented as the length of bars along the vertical y -axis
line graphs	measure the change in a variable (plotted along the vertical y -axis) over time (plotted along the horizontal x -axis)
error bars	lines extending in the positive and negative directions above and below data points on graphs to show the margin of error
scatter graphs	measurements are plotted along two continuous scales (the horizontal x -axis and vertical y -axis)
correlation coefficient	(represented as r) is a statistical measure that summarizes the degree of the association between two variables
linear regression line	help the readers visualize the correlation between two variables
y -axis	vertical axis on a graph
x -axis	horizontal axis on a graph
descriptive statistics	summarize (or “describe”) a data set
inferential statistics	extrapolate data from a sample to a larger population
central tendency	basic calculations that provide an “average” value such as the mean, median, or mode
mean	arithmetic average of a set of data
median	midpoint value in a set of data in which half of the values lie above and half lie below
mode	most common value in a data set
variability	degree to which the data values are close together or spread apart
distribution	the pattern of the data values
range	difference between the largest and smallest data values
sample	a subset of individuals from a larger group
population	the entire group that a sample represents
uncertainty	measure describing the accuracy or precision of the statistic
representative drawing	Shows the appearance of the relevant features of an object
translucent view (or cutaway) drawings	Shows the inner structure of an object
action view	Shows movement or process by showing stepwise actions in a

drawing	series of panels or a series of steps in a single image
symbolic diagram (or schematic)	Drawing that illustrates a phenomenon or process using established graphical symbols or representations
flowchart	Symbolic drawing that illustrates a process

Questions

1. In your own words, explain the difference between data and results. Describe how each should each be presented.
2. In your own words, explain what it means to “tell a story” in the Results section.
3. How is the Results section organized in an experimental (or hypothesis-)testing research? List and describe the contents of each subsection.
4. In general how does the content of exploratory investigations differ from that of experimental (or hypothesis-)testing research? How are subsections of exploratory investigations organized?
5. How is tense used in the Results section?
6. When should data be presented in a graph, table, or summarized in statistics?
7. What kind of data should be graphed in a bar graph?
8. What is the difference between a line graph and a scatter graph? What type of information should be presented in each?
9. Why are pie graphs uncommon in SMC? What is an alternative way to present the data in a pie graph? Provide an example.
10. Why should you avoid creating 3-dimensional bar graphs?
11. What happens to the data in a bar graph if you do not begin the Y-axis at zero or indicate a suppressed zero?
12. (a) Graph the following data showing human plague cases and deaths in the United States from 2000 to 2014. (b) Distort the data to deemphasize the large number of bubonic cases in 2006.

Year	Reported cases
2000	6
2001	2
2002	2
2003	1
2004	3
2005	8
2006	17
2007	7
2008	3
2009	8
2010	2
2011	3
2012	4
2013	4
2014	10

Source: CDC.

13. Examine figure 4 from the following article. Based on the information provided in the chapter, what is the major problem with the graph panels? How could you improve the graph?
McElroy, Anita K., Bobbie R. Erickson, Timothy D. Flietstra, Pierre E. Rollin, Stuart T. Nichol, Jonathan S. Towner, and Christina F. Spiropoulou. 2014. "Biomarker correlates of survival in pediatric patients with Ebola virus disease." *Emerging Infectious Diseases* 20 (10): 1683–90. Available at: <http://wwwnc.cdc.gov/eid/article/20/10/pdfs/14-0430.pdf>
14. Examine the data presented in Example 7.8 and answer the following questions. (a) What are the effective and ineffective features of this passage? (b) Convert the data into a table or graph. (c) After you have created a table or graph to show the data, rewrite the passage based on the recommendations from the chapter.
15. Read the Results section of the following article and create a participant flow diagram.
Hull, Sara Chandros, Luana Colloca, Andrew Avins, Nancy P. Gordon, Carol P. Somkin, Ted J. Kaptchuk, and Franklin G. Miller. 2013. "Patients' attitudes about the use of placebo treatments: telephone survey." *BMJ* 347: f3757. Text available at: <http://www.bmj.com/content/347/bmj.f3757>
16. Read the article below and revise the Results section based on the information presented in the chapter. In your revision, be sure to present the data effectively.
Rosser, James C., Paul J. Lynch, Laurie Cuddihy, Douglas A. Gentile, Jonathan Klonsky, and Ronald Merrell. 2007. "The impact of video games on training surgeons in the 21st century." *Archives of Surgery* 142 (2): 181–6. Text available at: <http://archsurg.jamanetwork.com/article.aspx?articleid=399740>

Links

Creating a Chart (or Graph) in Microsoft Excel

<https://support.office.com/en-us/article/Create-a-chart-4d95c6a5-42d2-4cfc-aede-0ebf01d409a8?ui=en-US&rs=en-US&ad=US>

Calculating Basic Statistics in Microsoft Excel

<https://support.office.com/en-us/article/Average-a-group-of-numbers-6cced0beca49-41c8-a3f2-cb89e566ab90?ui=en-US&rs=en-US&ad=US>

4.1.8 Chapter 8: The Discussion Section

Summary

This chapter provides an examination of the organization and style of content in the Discussion (and Conclusions) sections of a journal article. The chapter introduces Readers to four types of content for a complete Discussion. Several real-world discussion sections are annotated to illustrate the guidelines presented in this chapter. Additionally,

the connection between the Discussion and Introduction sections of a journal article are highlighted to show coherence throughout an article. This chapter also covers scientific writing style and specifically addresses issues and errors common in the Discussion section. A review of verb tense, passive versus active voice, and use of personal pronouns is specific for the Discussion section. Additionally, Readers are introduced to hedging words and phrases and shown how to present claims appropriately in science and medicine.

Flashcards

Term	Definition
Move 1	Present the principal claim
Move 2	Contextualize research findings by comparing the results of the current study to previously published research
Move 3	Analyze the research approach
Move 4	Provide the conclusions
Move 4-Step 1	Summarize the principal claim
Move 4-Step 2	Present the implications of the research
Move 4-Step 3	Provide specific recommendations for future research
generalized claim	Summarizes the findings of the results and occupy the research niche defined in the Introduction
hedging	tempered writing style used in SMC acknowledging the limitations inherent in the scientific process and allows room for your readers and future researchers to disagree and modify your research

Questions

1. What is the difference between the content in the Results and Discussion sections? Provide examples of content for each section.
2. How is the Discussion section organized?
3. What tense is used in the Discussion section?
4. How does the Discussion section extend or continue the narrative from the Introduction?
5. What is hedging? Find the hedging statements in the journal article listed below.
McElroy, Anita K., Bobbie R. Erickson, Timothy D. Flietstra, Pierre E. Rollin, Stuart T. Nichol, Jonathan S. Towner, and Christina F. Spiropoulou. 2014. "Biomarker correlates of survival in pediatric patients with Ebola virus disease." *Emerging Infectious Diseases* 20 (10): 1683–90. Available at: <http://wwwnc.cdc.gov/eid/article/20/10/pdfs/14-0430.pdf>
6. Analyze the use of tense, personal pronouns, and voice in the article listed in question 5. How is each style used?
7. Read the Discussion section from the journal article listed below.
Blaustein, Andrew R., Joseph M. Kiesecker, Douglas, P. Chivers, and Robert G. Anthony. 1997. "Ambient UV-B Radiation Causes Deformities in Amphibian Embryos." *Proceedings of the National Academy of Sciences*, 94: 13735–7. Available at: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC28375/pdf/pq013735.pdf>

- a. How does the content of this article compare to the standard content presented in the text? Mark each Move in this section.
 - b. Annotate the writing in the section for the style issues covered in chapter 8.
8. Read the Discussion section from the journal article listed below. (In this article, the Discussion section is labeled as “Comment.”)
- Rosser, James C., Paul J. Lynch, Laurie Cuddihy, Douglas A. Gentile, Jonathan Klonsky, and Ronald Merrell. 2007. “The impact of video games on training surgeons in the 21st century.” *Archives of Surgery* 142 (2): 181–6.
Text available at:
<http://archsurg.jamanetwork.com/article.aspx?articleid=399740>
- a. How does the content of this article compare to the standard content presented in the text? Mark each Move in this section.
 - b. Annotate the writing in the section for the style issues covered in chapter 8.
 - c. Annotate the writing in the section for the style issues covered in previous chapters of the text (in particular chapter 5).
 - d. Rewrite the section based on the content and style guidelines presented in the text.

Links

Is Pluto a Planet? Watch *The Pluto Files*

<http://www.pbs.org/wgbh/nova/space/pluto-files.html>

See Science in Action: *Secret of Photo 51*

<http://www.nytimes.com/movies/movie/389902/NOVA-DNA-Secret-of-Photo-51/overview>

4.1.9 Chapter 9: Summary Sections: Titles and Abstracts

Summary

This chapter covers the writing of scientific titles, running titles, and comprehensive abstracts for journal articles. In the chapter, the content and structure of these sections are connected to facilitating the database searches of scientific and medical literature. The difference between structured and unstructured Abstracts is discussed. A summary of content for comprehensive, structured Abstracts is included.

Flashcards

Term	Definition
running titles	abbreviated Titles that appear on the interior pages of an article
headers	Information printed at the top of a page
footers	Information printed at the bottom of a page
structured abstracts	List of subheadings that provide authors and readers with a framework for the content in an Abstract

Questions

1. Some argue that Titles and Abstracts are the most important sections of journal articles. What is/are the reason(s) for this argument?
2. How are Titles and Abstracts similar?
3. What content should be included in the Title of a journal article?
4. How are Titles in SMC different than titles of other genres (such as magazine article, newspaper articles, and books)?
5. What is a Running Title? How is it used?
6. What is a structured Abstract? How does it differ from a traditional (unstructured) Abstract?
7. Read the Title and Abstract of the journal article listed below. Does the Title follow the recommended structure of information presented in the text? If not, how would the Title be revised? What differences exist between the actual title and the revised title (based on the recommendations in the text)? What reasons might exist for the authors of this article having such changes?

Blaustein, Andrew R., Joseph M. Kiesecker, Douglas, P. Chivers, and Robert G. Anthony. 1997. "Ambient UV-B Radiation Causes Deformities in Amphibian Embryos." *Proceedings of the National Academy of Sciences*, 94: 13735–7. Available at: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC28375/pdf/pq013735.pdf>
8. Read the Abstract of the journal article below.
 - a. Revise the Title for the article based on the recommendations from the text.
 - b. Describe the changes that you made to the Title.
 - c. Create a running title based on your revised title.

Hadler, James L., Dhara Patel, Roger S. Nasci, Lyle R. Petersen, James M. Hughes, Kristy Bradley, Paul Etkind, Lilly Kan, and Jeffrey Engel. "Assessment of Arbovirus Surveillance 13 Years after Introduction of West Nile Virus, United States." 2015. *Emerging Infectious Diseases* 21 (7): 1159–66. Available at: <http://wwwnc.cdc.gov/eid/article/21/7/pdfs/14-0858.pdf>
9. Write a structured Abstract for the article listed in question 7. (You probably will need to read each section of the article to write a comprehensive structured Abstract.) How does your Abstract compare to the Abstract of the article? What information is included in your Abstract that is not included in the original Abstract?
10. Compare structured Abstracts to traditional Abstracts. What are the advantages and disadvantages of structured Abstracts?
11. Convert the structured Abstract you wrote in question 8 to an unstructured Abstract. Explain the changes you made.

4.1.10 Chapter 10: Preparing a Manuscript for Submission: Cover Letters, Publication Ethics, and the Peer Review Process

Summary

This chapter concludes the section on journal articles by covering the ethical practices associated with publishing scientific and medical research. Readers are shown how to

write a cover letter to a journal editor and to submit a manuscript to a scientific or medical journal. This chapter includes comprehensive instruction for proper blinding of the manuscript. Readers are introduced to the peer review process along with a discussion of the variations and limitations of the process. Finally, readers are provided the criteria used to evaluate manuscripts and the common reasons for rejection.

Flashcards

Term	Definition
cover letter	provides authors the opportunity to establish a direct dialogue with the journal editor and address issues, particularly ethical and legal issues, that are of concern to the editor
duplicate or redundant publication	research data that has been previously published
Ingelfinger rule	states that journals will not publish scientific findings that were published elsewhere
duplicate submission	research data simultaneously considered for publication by more than one journal or publisher
self plagiarism	plagiarism of one's own work (specifically repeating data or findings)
salami slicing	slang term for inappropriately dividing the results from a single study into multiple papers to increase the number of publications
meat extenders	slang term referring to the unethical practice of adding data to one's own previously reported research without reaching new conclusions for the purpose of getting another publication
publication bias	selectively communicating only favorable studies
corresponding author	the individual who will receive correspondence about the article from the journal editor
submission-management system	a content-management system designed to accept manuscripts electronically
electronic submission	submitting a manuscript online through a submission-management system
agents	individuals who are not the authors listed on a research manuscript but submit the manuscript to the journal on behalf of the authors
keywords	terms that authors provide to categorize articles and determine appropriate reviewers within the submission-management system
index terms	a list of controlled terms used by databases to categorize a journal article once published
blinding (or "anonymizing")	removing the authors' names and identifying information from the entire submission
peer review	evaluation of the scientific content and methods in a research manuscript by experts in the field
referees	individuals who review the scientific content and methods of manuscripts

	submitted to journals
blind (or masked) review	the referees' identities are not disclosed to the authors but the authors' identities are revealed to the referees
double-blind review	both the referees' identities are not disclosed to the authors and the authors' identities are not disclosed to the referees

Questions

1. What is the function of a cover letter with a journal article manuscript submission? What information should be included in cover letters?
2. What problems might arise if authors did not submit a cover letter with a journal article manuscript submission?
3. Watch the Video showing how to submit a manuscript to *Proceedings of the National Academy of Sciences* (available in the links section of the student website). How are submission-management systems changing the information that authors need to include in cover letters? What information is not specified in a content management system but common in cover letters that authors might decide to include in a comment to the editors and reviewers?
4. What is a submission-management system? What documents and information do you need to collect before submitting a journal article manuscript?
5. What is the peer review system? What are the objectives of peer review? What are the disadvantages of peer review?
6. Why do you blind (or mask) a manuscript? What should you do to blind a manuscript?
7. Who are the referees of manuscripts in peer review? What do the referees do? How does their role differ from that of a journal editor?
8. What is double-blind peer review? How does it differ from other forms of peer review?
9. What is/are the function(s) of Institutional Review Boards? Which research ethics are evaluated by Institutional Review Boards? Which research ethics are *not* evaluated by Institutional Review Boards?
10. What would be considered a conflict of interest in the funding of scientific or medical research? Provide an example.
11. What is self plagiarism? Why is self plagiarism unethical?
12. In general, what is/are the most common initial outcome(s) of the initial peer review of a manuscript? How should you respond to each outcome as a writer/author?

Links

Video showing how to submit a manuscript to *Proceedings of the National Academy of Sciences*
http://www.pnascentral.org/html/pnas_videos/express_submission.html

"What Editors Want" from *The Chronicle of Higher Education*
<http://chronicle.com/article/What-Editors-Want/45909>

“Scientists Behaving Badly” from *Nature*

<http://www.nature.com/nature/journal/v435/n7043/full/435737a.html>

4.1.11 Chapter 11: Introduction to Conferences and Meetings

Summary

This chapter covers the steps to identify and apply to present research at scientific conferences. Presenting at scientific conferences enables researchers to share research in progress with the scientific community prior to publishing the research in a peer-journal article. Presenting research at conferences also provides researchers with many personal benefits ranging from enhancing the research prior to publication to networking. The major issues covered in this chapter include selecting an appropriate conference to present research, collecting the requirements and timeline for submitting a conference Abstract (the presentation proposal), and writing a conference Abstract.

Flashcards

Term	Definition
conference abstract	brief proposal that describes the research one intends to present at a scientific conference
Instructions for Presenters	set of guidelines for presenters to prepare and submit proposals and presentations to conferences

Questions

1. Compare a contrast conference Abstracts to the Abstracts of IMRAD journal articles. How are they similar? How are they different?
2. Select an upcoming annual meeting in your discipline (or one of the annual meetings listed in table 11.1). Find the Instructions to Presenters and answer the following questions:
 - a. When is the next conference?
 - b. When are Abstracts due for the conference?
 - c. What are the word/character limitations for the Abstract?
 - d. Are there any other special requirements or limitations mentioned for Abstract submission? If so, what are they?

Links

“It Starts with a Poster” from *Science*

<http://www.sciencemag.org/content/347/6226/1047.full>

4.1.12 Chapter 12: Creating Scientific Posters

Summary

Scientific posters are the most common oral presentation genre at scientific and medical conferences. Scientific posters are used as visual aids at poster sessions to facilitate presentation and discussion of research data. This chapter covers the format (or design), content, and printing of scientific posters to facilitate an effective poster presentation. In

addition, this chapter describes the expectations of presenters at scientific meetings and conferences.

Flashcards

Term	Definition
scientific poster	large visual display of data to facilitate a research presentation
poster session	common presentation and discussion format at scientific conferences
conference program	catalog of research presentations that is distributed online or in print at the beginning of the conference
Instructions for Presenters	set of guidelines for presenters to prepare and submit proposals and presentations to conferences
typeface	commonly yet imprecisely called “fonts,” are the names for the design of an alphabet and characters
font	all of the typefaces of a single size
serif typeface	include serifs, the small projections at the ends of letters (e.g., Times)
sans serif typeface	typefaces that do not include any projections at the ends of letters (e.g., Helvetica)
presenting author	the one who stands alongside the poster and discusses the content with attendees
tiling	printing option in which a large document is divided into sections that fit when printed on standard size paper

Questions

1. What is a scientific poster? Describe how scientific posters are used to support conference presentations.
2. Compare and contrast conference scientific posters to IMRAD journal articles. How are they similar? How are they different?
3. What are the major limitations that you need to consider when creating a scientific poster? How will each limitation influence your selection of content or design of the poster?
4. Should you include an Abstract on a scientific poster? Why or why not?
5. Browse the online database of scientific posters at F1000 Research archives scientific posters from conferences (available on the links section of the student website). Select a poster that is well designed. Provide a detailed critique of the poster design: What is/are the effective design elements? Why is/are each effective? Are there any modifications that you would make to the poster to make it more effective for the context of the presentation at the conference? (Be sure to include a direct link or other identifying information so that the poster can be accessed again.)

Links

F1000 Research archives scientific posters from conferences
<http://f1000research.com/subjects>

4.1.13 Chapter 13: Public Communication Strategy and Ethics

Summary

This chapter covers the issues associated with communicating scientific and medical findings to the general public. Specifically, this chapter examines the scientific literacy of general audiences and describes a media-relations strategy for scientific and medical researchers. In addition, this chapter covers the ethics of communicating research findings with the news media and general public.

Flashcards

Term	Definition
general (or lay) audience	an audience of individuals who lack specialized education or training in the subject area
Ingelfinger rule	states that journals will not publish scientific findings that were published elsewhere
science communication	dissemination of scientific research findings to general audiences
health communication	dissemination of medical research findings to general audiences

Questions

1. What is a science communication? How does it differ from scientific communication?
2. What are the features and characteristics of a general (or lay) audience? How do these features and characteristics influence your communication of scientific information?
3. What “spin” do reporters often put on scientific and medical stories? Can you find one or more recent examples of such spin?
4. When should a scientific or medical discovery be reported to the public? Why should you avoid preliminary announcements?

Links

Discover Magazine

<http://discovermagazine.com/>

Scientific American

<http://www.scientificamerican.com/>

4.1.14 Chapter 14: Writing Press (News) Releases

Summary

A press release (sometimes called a news release or press statement) announces research innovations to the news media. Scientists, physicians, and professional writers are often involved in the writing of a press release. This chapter examines the issues of communicating scientific and medical information to general audiences. The major issues

covered in this chapter include the features of general (non-technical) audiences, writing styles and issues for communicating to a general audience, content and organization of a press release, and distributing a press release to the news media.

Flashcards

Term	Definition
press release (news release or press statement)	written and disseminated by universities, companies, government organizations, and other institutions to announce something of news value
lead	the first sentence of a press release or news article, which states the impact, novelty, timeliness, or usefulness of the information to the reader
hard lead	provides a comprehensive summary of the news
soft lead	consists of a creative, attention-grabbing introduction (commonly found in long feature articles)
5 Ws	questions to answer in a news story: who? what? where? when? and why?
inverted pyramid	organization of content in news articles from most to least important
technical summary	short overview of the research findings summarized at the top of a press release
boilerplate	a short paragraph that provides background information on the university, company, government organization, or institution
embargo	delay in the publication of news until a certain date

Questions

What is a press release?

1. Who is/are the audiences of press releases?
2. What is the content of a press release?
3. How are press releases organized?
4. What is the inverted pyramid?
5. How should you communicate to a general audience?
6. Go to the press (news) release section of your university's website. Find a recent press release for a scientific discovery. Analyze the press release based on the content, style, and organization presented in this chapter. Is the press release complete? Is any information missing? What other recommendations would you suggest to improve the press release?

4.2 Major writing assignments

In the following subsections, major writing assignments are organized by genre and correspond to sections of the text:

- Section 2: IMRAD journal article,
- Section 3: Scientific poster, and

- Section 4: Press release.

The major writing assignments are described below.

4.2.1 Section 2: IMRAD journal article

A complete IMRAD journal article is challenging for students due to the technical content and varying style of each section. In regards to the content, instructors may take one of the following approaches that I have found successful in undergraduate and graduate courses:

- Select a published journal article and have students do a **comprehensive revision of the paper**. For this assignment, instructors should select an article that adequately provides students the opportunity to reorganize, revise, and rewrite. Since the content must be comprehensible to students, I have found it difficult to find published research articles that meet all of these criteria. One example of an article that might be used for this assignment is: Young, Meredith E., Geoffrey R. Norman, and Karin R. Humphreys. 2008. "Medicine in the popular press: The influence of the media on perceptions of disease." *PLoS One* 3 (10): e3552. Available at: <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0003552>
- **Design a mini-experiment** in the class with the purpose of collecting data to write an IMRAD-journal article. For example, students may design a survey or small activity (such as correlating video game skill to some variable, such as major) and then conduct the investigation. This research must be based in previous research, which often falls into the education or communication fields. The benefit to this approach is that students become immersed in the situated learning experience and that the Introduction, Methods, and Results are realistic and tangible. However, students often produce limited data from such approaches and this makes the Results and Discussion sections rather short and simple. Additionally, instructors should be cautious not to let the research design overshadow the writing part of the assignment.
- Alternatively a **different approach for each section of the IMRAD journal article** may be ideal. When assigning an IMRAD journal article as a major writing assignment, instructors often breakdown the project into each major section. The mini-experimental approach might be most effective for the Introduction, Methods, and Results section whereas a revision of a published journal article might be most effective for the Introduction and Discussion sections.

4.2.2 Section 3: Scientific poster

For this assignment, students select a published IMRAD journal article and convert the content to a scientific poster following the guidelines presented in the text. On the day of presentation, students post the poster on the wall and deliver a 3 to 5-minute presentation of the content to the class.

Guidelines and suggestions:

- Students should refer to the chapter on searching the literature to select an appropriate database for their topic. Instructors should emphasize that designing the content for the poster format requires a thorough understanding of the content and substantial revision of the presentation format. Students should focus on the data tables and figures from the research articles.
- Presentations should be visual with at minimum 1 table and 2 different types of figures. (Students should select articles carefully so that they have appropriate content for the presentation. Students may have to find another article if the content does not lend itself to the poster format.)
- Students should download (and submit) an original PDF of the complete journal article. I have students independently evaluate the content to ensure that they understand the material and that the data lends itself to visual presentation. Students will have to read and evaluate the content, so instructors might have the students write a 1- to 2-page summary of the paper.
- Instructors should have students evaluate the article early in the assignment and also review the article type (ensure that it is a journal article rather than literature review) and also the content to ensure that it is appropriate for the assignment.
- Students must recreate all images—going back to the original data and selecting the presentation format. They should not necessarily rely on the original selection of presentation format or graph but rather think of the most effective way to communicate the data.
- Dimensions for the poster should be set to The American Society for Cell Biology dimensions for poster presentations at this year’s conference. (You can select a different conference that is most appropriate for your students. Identifying a specific conference gives students practice looking up the answers to their format questions.)
- In general poster should be designed in Microsoft PowerPoint and submitted either as a PDF (for proper display from a projector) or printed. Students often find PowerPoint templates on the web for scientific posters, so instructors should decide if they want to permit templates. (I often allow students to use templates from the university or department because this is standard practice.)

4.2.3 Section 4: Press release

For this assignment, students should identify a faculty member at the university who is working on novel research. Using your university as the “institution,” students should write a press release announcing the research.

The press releases should be formatted as described in the text and include boilerplate information for the institution. (Students should visit the university’s website and read recent press releases. If boilerplate information is not available on the university’s press releases, then students can write mock boilerplate information from reading about the university online.)

Students may find faculty by browsing the faculty profiles posted in science and engineering departments. Students should contact the faculty member and do a brief interview of their research for quotes. The student should also collect one or more recent articles on the research to use as a reference.

References

- Harmon, Joseph E., and Alan G. Gross. 1996. "The Scientific Style Manual: A Reliable Guide to Practice?" *Technical Communication* 43 (1): 61–72.
- Woodford, F. Peter. 1967. "Sounder Thinking Through Clearer Writing." *Science* 156 (3776): 743–5.

Appendix A: Sample Syllabus for a Course in Scientific and Medical Writing

Two-day a week schedule for a 16-week semester.

Class Session	Topic	Reading Assignment
1	Course introduction	
2	Introduction to SMC and the role of effective communicators	Chapter 1
3	Genres of SMC and connecting SMC to the scientific method	Chapter 2
4	Searching the scientific and medical literature: Database strategies and file management	Chapter 3
5	Proper citation practices	Chapter 3 (continued)
6	Planning and preparing IMRAD journal articles of original research; Audiences and discourse communities	Chapter 4
7	Selection of a target journal	Chapter 4 (continued)
8	Introduction section: The CARS model	Chapter 5
9	Introduction section: Writing style	Chapter 5 (continued)
10	Peer editing workshop for Introduction sections	
11	Methods section: Purpose and organization	Chapter 6
12	Methods section: Writing style	Chapter 6 (continued)
13	Peer editing workshop for Methods sections	
14	Results section: Purpose and organization	Chapter 7
15	Results section: Writing style	Chapter 7 (continued)
16	Data presentation 1: Tables and graphs	Chapter 7 (continued)
17	Data presentation 2: Statistics and visuals	Chapter 7 (continued)
18	Peer editing workshop for Results section	
19	Discussion section: Purpose and organization	Chapter 8
20	Discussion section: Writing style	Chapter 8 (continued)
21	Peer editing workshop for Discussion section	
22	Summary sections: Titles and Abstracts	Chapter 9
23	Preparation of manuscripts for submission to a journal and the peer-review process	Chapter 10
24	Scientific conferences and scientific posters	Chapters 11 & 12

25	Designing scientific posters	Chapter 12 (continued)
26	Workshop for preparing scientific poster	
27	Presentation of scientific posters	
28	Presentation of scientific posters	
29	Communicating scientific information to the public; Writing press releases: Content and style	Chapters 13 & 14
30	Peer editing workshop for press releases	
31 (Finals Week)	Final Exam	

Appendix B: Research Worksheet (Handout)

Article Name	
Journal Name (complete title)	
Author(s)	
Year Published	
Volume	
Pages	
Article Type (highlight one)	Research Article OR Literature Review

What is the research question, hypothesis, or purpose of the study?	
What is/are the major finding(s) of the paper?	

Appendix C: Record of Database Searches (Handout)

Date	Database	Type of Database Search			Search Parameters & Database String	Number of Results
		Keyword	Forward tracking	Related articles		