

7.02/10.702—Scientific Communication (SciComm)

Scientific Communication Instructors

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Class Description

If the goal of science is to contribute to our understanding of the natural world, then the goal of scientific writing is to communicate that understanding with precision, accuracy, and economy. In this course, you will develop your skills as a writer of scientific research, skills that will contribute to your learning of course material and to creating your identity as a scientist. Writing exercises—both in class and out—will have you explore the genre of the research article and its components and develop your grasp of the material you are learning in 7.02/10.702. In this way, writing will be both a tool of communicating and a tool of learning. In addition, you will develop your skills as a writer, reviser, and editor—working with your peers and your instructor—and, ultimately, develop a solid foundation for writing up your future independent research.

Class Meetings—Spring 2005

<u>Section</u>	<u>Day/Time</u>	<u>Instructor</u>
A	M 9-11	Ogren
B	M 1-3	Ogren
C	M 1-3	Kelley
D	T 9-11	Pepper
E	W 9-11	Ogren
F	W 1-3	Kelley
G	Th 9-11	Lerner
H	Th 1-3	Lerner

Class Objectives

At the conclusion of this class, students will be able to:

- Understand the seven components (title, abstract, introduction, methods, results, discussion/conclusion, tables/figures) of a laboratory research paper.
- Understand the writing process and its application to scientific writing.
- Understand the importance of communicating in writing as a scientist.
- Apply an understanding of scientific writing to their subsequent independent research.

Class Methods

In-class Activities:

During each class session you will be engaged in a variety of writing activities that use self-editing, peer-editing, and instructor feedback to develop your skills. The goal of these exercises is to limber you up and make you more flexible as writers, revisers, and

editors. They will also prepare you for the out-of-class writing assignments.

In addition, during each session three or four students will be responsible for a brief (no more than 5 minutes each) oral presentation on a particular aspect of a research article previously made available on the 7.02 website. The four assigned roles for these presentations are to 1) summarize the article, 2) analyze the article according to the goals of that particular component of a scientific research paper, 3) analyze the article according to the pitfalls of that particular component of a scientific research paper, 4) act as a discussion leader and ask two to three open-ended questions to class.

Out-of-Class Writing:

Out-of-class exercises will put in-class experience to work on scientific content. You'll experiment with the relationship between audience and style/format, as well as explore and critique writing the readings assigned for each class. Further descriptions of out-of-class exercises will be provided during each class meeting.

Long-Term Project:

In addition to various in-class and out-of-class exercises, you will be asked to choose one on-going writing project. Each choice will require that you turn in sections of the whole at each class meeting and regularly revise those sections based on instructor and peer feedback. You will then hand in a final version of your project at the end of the semester by May 6. **Please note:** The first section to your long-term project—the introduction—will be due before the second class meeting and some preliminary work on your project will be done at the first class meeting; thus, please make your topic choice as soon as possible.

Choices are as follows:

#1—7.02/10.702 Experience: Write a reflective research article on yourself as a student learning the laboratory techniques and biological content of 7.02/10.702.

Your own learning is the subject of inquiry or data set for this research project, and you will apply the features of biological research writing to report on—and better understand—what it is you are learning in 7.02/10.702 lecture and lab. The idea here is of reflective learning; your 7.02/10.702 experience will be enhanced if you go beyond treating your learning as mere dictation or rote imitation. By writing about your learning—and thus gaining a measure of control over what you know and what you still need to know—you will ultimately learn more. This process also mimics the thinking process required of any researcher, whether in biology or other fields. You do not merely generate lists of potential experiments, or interesting questions to pursue, or experimental data, but instead you constantly question why you are making those choices, what the potential and actual results might be, and what those results might mean in the context of what we already know about the “problem.” You will study and present your learning using the structure of a scientific research article, and for each class session a writing assignment will be due under these headings:

Introduction: Establish the context for yourself as a learner coming in to 7.02/10.702, justify the course in some larger sense (how does it fit within your “bigger picture”), establish specific goals for your learning and describe

how you will measure that learning (i.e., what your learning will look like).
Methods: Focus on *how* you've learned the lecture and lab material. What has your studying looked like (e.g., in groups, alone, specific procedures, strategies)? What has your performance in lab looked like? Be sure you clearly define what you mean by "learning" and how you've measured it.
Illustrations: Create at least two illustrations (figures or tables) to demonstrate the methods or results of your study of your learning in 7.02/10.702.
Results: Present the results of your learning in 7.02/10.702. What have you learned in terms of scientific content? What have you learned about yourself as a learner?
Discussion/Conclusion: Were your results as you expected (i.e., match the specific goals you established in your introduction)? Why or why not? How might you have designed your study differently to accomplish your intentions? What are the larger implications of your results?
Title and Abstract: Create a succinct, descriptive title and a comprehensive abstract for your study.

The final graded project will be a research article of 10-15 double-spaced pages in length, along with a title page, and a summary letter of transmittal describing your project and its construction.

*#2 – Mendel Paper: Use selected data and related aspects of the experimental design from Mendel's original paper to write a shortened, more contemporary scientific paper. **

You are Gregor Mendel at the completion of his famous experiments with pea plants. Use the knowledge you gain in this course about scientific writing to create a shortened version of Mendel's work. Your paper should **focus only on the findings in pea plants that support of the law of segregation (monohybrid crosses) and the law of independent assortment (dihybrid crosses)**. **Do not paraphrase Mendel's original paper.** Write a completely new paper. Use Mendel's original paper only as a resource for the experimental design and his original data. Keep in mind that Mendel did not know about chromosomes, genes, alleles, or DNA.

Mendel's original paper and other resources describing what scientists thought about inheritance in the late 1800's can be found on MendelWeb: <http://www.mendelweb.org>. These include a chapter on Mendelian genetics, an essay entitled "Mendel, Mendelism, and Genetics" by Robert C. Olby, an essay entitled "What Did Gregor Mendel Think He Discovered?" by Daniel L. Hartl and Vitezslav Orel, and materials related to Darwin's theory of evolution, which was introduced at about the same time.

Mendel's original paper is over 40 pages long. Your final draft should be about 10-15 pages double-spaced. Revisions are a crucial part of the project. At each class meeting you will receive feedback on your previously submitted section. It will be your responsibility to incorporate this feedback and adjust other sections to make a final paper that is coherent and flows from beginning to end. Please include a title page and a cover letter with your final draft. All figures should be grouped at the end of the document.

*Variants of this choice are welcome, but subject to instructor approval, e.g., Thomas Hunt Morgan's work with fruit flies that led to linkage analysis.

#3—Oswald Avery paper: Use selected data and related aspects of the experimental design from Avery et al.'s original paper isolating DNA as the "active principle" involved in transfer of genetic material and write a shortened, more persuasive, and more contemporary scientific paper.

In his essay, "The Birth of Molecular Biology," S. Michael Halloran points to the 1944 Avery et al. *Journal of Experimental Medicine* article as an example of a groundbreaking scientific finding that reached a very limited audience primarily due to the ways in which the paper was written. According to Halloran, "[a] characteristic point of [the authors'] argumentative strategy is that the paper does not state its thesis in the introductory section and in fact does not even mention the substance DNA until roughly half-way through its 7500 word length." Halloran goes on to describe the paper as "rhetorically weak."

In this long-term project, your task is to make Avery et al.'s argument "rhetorically strong" by re-fashioning their experimental work in an updated form.

Background on Oswald Avery's life and work, as well as his notes surrounding the 1944 paper, can be found at the National Library of Medicine's Profiles in Science website: <http://profiles.nlm.nih.gov/CC/>. The *Journal of Experimental Medicine* article itself can be found at that website and on the SciComm "Writing Lectures" page.

Your final graded project will be a research article of 10-15 double-spaced pages in length, along with a title page, and a summary letter of transmittal describing your project and its construction.

#4—UROP: Use the data and experimental design from your independent research to compose a research article suitable for publication in a scholarly journal.

Write a formal research article presenting your undergraduate research. You must have sufficient data at the *beginning* of the semester to undertake this project. Specifically, you must have enough data to develop a substantial results section with convincing illustrations. Students who have just begun their undergraduate research should make another choice.

This exercise is intended to be on going and iterative. Revisions are a crucial part of the project. At each class meeting you will turn in a new section and receive instructor feedback on your previously submitted section. It will be your responsibility to incorporate instructor feedback and to make your own modifications to previous sections so the end result is coherent and flows from beginning to end.

Your final paper should be about 10-15 pages double-spaced. Please include a title page and a cover letter with your final draft. All figures should be grouped at the end of the document. Consult the BCM Guide for Authors for other details.

#5—*Interviews: Investigate the process of writing scientific research and the “norms” of well-written research articles by interviewing working scientists and collecting examples.*

Students choosing this project will “go out into the field” in the manner of an anthropologist or social scientist in order to investigate the research article from the perspective of working scientists. For each section (introduction, materials and methods, illustrations, results, conclusion/ discussion, title and abstract) you will need to interview three or four scientific professionals in terms of the following:

- What does the scientist see as the criteria for a well-written introduction (or methods, etc.)?
- How does that scientist describe his or her process for writing that particular section?
- Have the scientist point you to one or two specific examples of well-written research articles that you will present in your report.

For each section, you will then present your findings from those you interviewed, noting similarities and differences in responses, and also present your analysis of what makes the textual examples particularly effective.

The final graded project will be a research article of 10-15 double-spaced pages in length, along with a title page, and a summary letter of transmittal describing your project and its construction.

#6—*Textual Analysis: Conduct a textual analysis of a series of scientific research articles on a single topic.*

For a topic that particularly interests you, find at least four research articles that you can understand and present to a lay reader. For each section of the research article (introduction, materials and methods, illustrations, results, conclusion/ discussion, title and abstract), you will conduct a textual analysis of how the authors “do the work” of writing up scientific research (for examples of this sort of analysis, see S. Michael Halloran’s “The Birth of Molecular Biology: An Essay in the Rhetorical Criticism of Scientific Discourse,” and Gopen and Swan’s “The Science of Scientific Writing, both available on the SciComm web page). Keep in mind that for each section of your paper, you will be presenting to your reader both the *content* of the research articles or what the authors have to say about the topic and the *rhetoric* of the articles or how the authors have constructed their arguments.

Overall, your approach to this task should be governed by the content and arguments of the articles themselves. For example, some topics lend themselves to an analysis of how the writing up of the research has changed over time. Another variation is to offer analysis of each section of the four articles, e.g., comparing/ contrasting the introductions, the methods, the results, the discussion/ conclusions, the title and abstract. With this approach it is essential that you provide appropriate examples to support your analysis.

Still another variation is to write your analysis in a more “traditional” way: In your introduction, you’ll need to introduce your reader to your project—Why you chose that

topic and why it is important, how you've generally approached the analysis, and what you hope to gain. In your methods, you would describe in detail your means of analysis. In your results, you'd offer the comparison/contrast of the articles themselves. In your discussion, you would offer explanations for the similarities and differences.

The final graded project will be a research article of 10-15 double-spaced pages in length, along with a title page, and a summary letter of transmittal describing your project and its construction.

Grading

Your grade in the Scientific Communication section of 7.02/10.702 (SciComm) is based on the work described below, and SciComm is worth 25% of your overall grade in 7.02/10.702.

I. "In Class Work" (20%)

- Attendance and participation (in discussion and in writing activities)
- Oral presentation
- Provides useful feedback on his/her peers' writing (peer tutoring)

II. "Out of Class Work" (30%)

A. Professional Improvement

B. Five Non-Long Term Project writing assignments (to be announced)

III. Long-Term Project (50%)

A. Long-term project (LTP) drafts (25%)

- LTP Intro draft
- LTP Methods draft
- LTP Results draft
- LTP Figures draft
- LTP Discussion draft

B. Long-term project title and abstract (5%)

C. Long-term project final draft (20%)

Revision Policy and Grading Schemes

I. Revision policy

A major part of the scientific writing process is revision, and thus you will have the opportunity to rewrite your SciComm “out of class” assignments and your LTP drafts. Revision will improve not only your writing but also your score on that assignment. The following guidelines govern rewrites in 7.02/10.702 SciComm:

1. **One** rewrite is allowed for each assignment.
2. Rewrites must be turned in by **one week** after assignment is returned.
3. Higher score of the two is recorded.

II. Grading of Oral Presentations

<i>Grade</i>	<i>Presentation quality information</i>
+	Superior presentation. Talk has structure/organization; presenter has good eye contact/rapport with audience; speaks clearly and correctly. Uses visuals where appropriate.
√+	Good presentation. Requires only minor improvements in any of the areas above.
√	Acceptable presentation. Requires moderate improvements in one or more of the areas above.
√-	Poor presentation (doesn't care or prepare)
0	Fails to complete oral presentation.

III. Grading of Writing Assignments

<i>Grade</i>	<i>Qualities of writing embodied by this score</i>
+	Thoroughly superior work. A model of good scientific writing.
√+	Good work. Requires only minor improvements in any of the following areas: organization of ideas; economy of expression; diction (word choice); grammar/punctuation/spelling.
√	Acceptable work. Requires moderate revision in one or more of the areas above.
√-	Acceptable but rough work. Requires substantial revision in all areas.
-	Unacceptable work.
0	Assignment not handed in.

Additional Information

I. Policy on Absences

Students are required to attend all class meetings. In accordance with MIT policy, students unable to attend classes or participate in any exam, study, or work requirement on a particular day because of their religious beliefs are excused from such activities. Students who need to miss a class session must attend another section meeting (with prior permission of the instructor) covering the same material (Introduction, Methods, etc). Absence from class due to illness requires documentation from the Counseling Dean's Office.

II. Late Work

All work is due on announced date except in the event of a documented medical excuse. For all final drafts, one letter grade will be deducted for each day late until a grade of F is reached.

III. Academic Honesty

Plagiarism is intentionally or unintentionally using the ideas or writings of another person without properly documenting and giving credit to the source. It will *not* be tolerated. Plagiarized work will receive zero credit and may result in the student failing the course. If you have any questions about what constitutes plagiarism, see one of the Instructors.