



Creating Successful Campus Partnerships for Teaching Communication in Biology Courses and Labs

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Creating and teaching successful writing and communication assignments for biology undergraduate students can be challenging for faculty trying to balance the teaching of technical content. The growing body of published research and scholarship on effective teaching of writing and communication in biology can help inform such work, but there are also local resources available to support writing within biology courses that may be unfamiliar to science faculty and instructors. In this article, we discuss common on-campus resources biology faculty can make use of when incorporating writing and communication into their teaching. We present the missions, histories, and potential collaboration outcomes of three major on-campus writing resources: writing across the curriculum and writing in the disciplines initiatives (WAC/WID), writing programs, and writing centers. We explain some of the common misconceptions about these resources in order to help biology faculty understand their uses and limits, and we offer guiding questions faculty might ask the directors of these resources to start productive conversations. Collaboration with these resources will likely save faculty time and effort on curriculum development and, more importantly, will help biology students develop and improve their critical reading, writing, and communication skills.

INTRODUCTION

Communicating ideas and discoveries in biology is arguably as essential and challenging as conducting the science itself. Writing and communication tasks can be assigned both to help biology students learn area content and to prepare them to conduct and communicate research effectively. Both the 2012 American Society for Microbiology (ASM) Curriculum Guidelines (1) and the 2009 American Association for the Advancement of Science (AAAS) *Vision and Change* report on undergraduate biology education (2) recognize the importance of effective communication, particularly emphasizing the need to facilitate effective collaboration across disciplines. Well-designed writing assignments are correlated with reports of persistent gains in higher-order learning, integrative learning, and reflective learning (3), according to a recent survey of over 70,000 US undergraduates. This study further suggests that it is the quality of the assignment, rather than the required amount of writing, that matters most.

Introducing a well-designed writing assignment, even a short one, into a microbiology or biology course can be quite challenging. Adding a writing assignment to a course typically requires taking something else out. If time for such work can be found, questions emerge regarding resources and approach: How do I develop a well-designed assignment? What can I assume my students already know about writing? What kinds of instruction or resources will biology students need to write and communicate successfully? How do I make sure students receive adequate guidance and feedback, especially if they struggle with writing?

Such challenges and questions may seem daunting or even overwhelming. This special issue of the *Journal of Microbiology and Biology Education* offers a wealth of evidence-based ideas and guidance, and the works cited by these articles point toward the longer history of pedagogy scholarship on communication in science. However, the increasingly robust scholarship on teaching communication in biology should not lead you to ignore the valuable local resources that exist right on your campus. Unfortunately, these local resources may be partially or totally unknown to many faculty (4).

This article seeks to introduce and explain the resources for the teaching and learning of communication in biology that exist on most US college campuses. More specifically, we will discuss three clusters of resources: 1) writing across the curriculum (WAC) and writing in the disciplines initiatives (WID), 2) writing programs, and 3)

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writing centers. Since these resources are typically housed outside of biology departments and science divisions, they may be unfamiliar to biology faculty who could benefit from them. Our goal is to help you understand what to expect and how to maximize what you and your students get out of each possible collaboration. In what follows, we detail the missions, histories, and approaches of each resource. Table 1 summarizes these characteristics and presents specific possible outcomes of collaborations between biology faculty and these resources.

WRITING ACROSS THE CURRICULUM AND WRITING IN THE DISCIPLINES INITIATIVES

Many universities and colleges have formal or informal initiatives to promote the teaching of academic writing in a diverse array of classes. Often, these initiatives have directors or consultants whose job responsibilities include collaborating with faculty on writing assignment design and implementation. A study of the prevalence of these programs from 2006 to 2008 revealed that 51% of US colleges had such a program and 27% had plans to build one (16). Broadly speaking, such programs have gone through three major stages: 1) the grant-funded workshop model of the 1970s and 1980s, 2) the institutionalized writing-intensive course-based model of the 1980s and 1990s, and 3) the practice of embedding writing in as wide an array of courses as possible, which began in the 2000s and continues to develop today (17). These initiatives share the goal of promoting student writing in more courses, but their names denote different emphases. We will discuss “writing across the curriculum” and “writing in the disciplines” programs in more detail.

Writing across the curriculum programs emphasize the need for students to write throughout their coursework. These programs prioritize writing as a tool for active learning, and they often encourage the inclusion of writing-to-learn assignments in which the process of writing is important for learning, but the written product itself is less meaningful. Randy Moore’s work from the mid-1990s offers more detailed explanations and evidence supporting this approach in science courses (18) as well as specific descriptions of how it can be incorporated into biology courses (8).

Writing in the disciplines (WID) programs, in contrast, emphasize the final product of writing and seek to help students gain mastery in the specific genres that characterize professional scholarly communication in a field. Instead of writing-to-learn, they emphasize writing-as-professionalization. These programs are attuned to the ways disciplinary values, habits of mind, research questions, and methods manifest themselves in the types of writing produced in that field. They take seriously the idea that in teaching students to write like biologists, we teach them to think like biologists, and this is not incidental to their education. Writing in the disciplines programs encourage content-area experts, rather than outside lecturers, to teach writing, seeing their fluency in disciplinary discourse as fundamental to this task.

An exemplar of the WID philosophy can be found in Moskovitz and Kellogg’s explanation of how to effectively assign writing in laboratory courses (19).

The primary goal of WAC/WID professionals is to help faculty successfully design and implement writing assignments in a wide variety of courses. The 2014 statement of WAC Principles and Practices, which elaborates on the history and goals of these initiatives, exemplifies the current tendency toward blending the two approaches. Directors of these programs are highly motivated to see that writing is not just assigned to students, but that it is also effectively taught. This can make them incredibly valuable interlocutors. They should be familiar with the most common challenges that an instructor assigning writing in a science course will be negotiating and with a host of ways to navigate them. They may have access to models of similar assignment materials or activities you can adapt or use as inspiration, and they are likely to know who on your campus is doing similar work in the classroom. At your invitation, these experts will typically be willing to review your course materials and anticipate the problems you may have before you encounter them.

Writing across the curriculum and writing in the disciplines faculty and staff may be in varied locations and have a variety of disciplinary backgrounds. Many formal WAC/WID programs will be housed in a writing or English department, but they could also be attached to a writing center or housed in an academic dean’s or provost’s office. The faculty and staff in charge of these initiatives may have PhDs in rhetoric and composition (also called writing studies), having trained to do research and teaching in exactly this area. Others will have come to this work after advanced training in some other field. Some are scientists or engineers who have become interested in pedagogy and communication. You are likely to find them eager to learn about your own experiences with and understanding of communication in your field, and your collaboration may well begin with such a discussion. The level of collaboration offered can vary as well. Many WAC/WID colleagues will be willing collaborators on developing assignments or other course materials, while others may prefer to restrict their support to offering feedback on materials you develop. What should be true regardless of their location and background is that they will be excited to understand and support your efforts to teach writing to biology students and able to connect you with varied resources to support those efforts.

¹For us, and for most colleagues you will meet whose work focuses on the teaching and learning of writing, the term “academic writing” is a capacious one, including both the classroom assignments given to students and the research-related writing on which that classroom writing is often modeled. It is inclusive of types of writing as diverse as argument-driven essays, review articles, lab reports, posters, journal articles, book chapters, technical reports, grant proposals and progress reports, and abstracts. At institutions with law, business, medical, or other professional schools, the genres in which professionals and students in those fields write may also be referred to as academic writing.

TABLE I.

Overview of resources for teaching and learning communication and potential collaboration outcomes.

Resources to Support the Teaching of Communication	Basic Mission of Program	Examples of Possible Outcomes of Collaboration with Faculty and Staff in Each Program
Writing across the curriculum (WAC)	Promotes assigning writing as a part of active learning across all disciplines and courses	<ul style="list-style-type: none"> Helping with developing new writing assignments to encourage active learning, such as 1) short, reflective writing assignments throughout a course to facilitate learning of complex topics in microbiology (5) or 2) a mini-review article addressed to a non-expert reader, to give students practice in identifying critical issues and putting complex biological concepts in clear, accurate terms (6) Assisting effective incorporation of more reading into a biology course as models of academic writing (7) and/or popular writing about biology (8, 9)
Writing in the disciplines (WID)	Encourages formal writing assignments that anticipate or mimic the real communication scholars and professionals do in the field	<ul style="list-style-type: none"> Developing strategies for giving more effective feedback for biology writers (10) Helping create a new (or improve an existing) assignment to teach biology-specific discourse in lab reports (11) or oral scientific presentations of research projects (12) Introducing models for incorporating peer review in the professional style of a biological manuscript submission to improve student writing and increase understanding of research communication (13)
Writing programs	Aim to introduce students to academic writing and discourse	<ul style="list-style-type: none"> Gaining a better understanding of how/whether students are taught visual rhetoric in first-year writing, so that a discussion of designing effective biology figures builds on students' existing knowledge Understanding what training students have in narrative writing, so that a discussion of how and why scientists tell stories can help students differentiate scientific and humanistic approaches to narrative
Writing centers	Support students as they work on varied writing projects across their college careers	<ul style="list-style-type: none"> Developing a partnership with a writing fellows program that brings trained peer tutors into a course to assist students with a writing assignment (14) such as a lab report (11) Participating in tutor training and providing model biology papers to a writing center director, so that writing center tutors are well prepared to successfully assist your students (15) Having writing center staff develop and lead in-class or supplemental instructional workshops to give students an understanding of biology-specific genres, audiences, and styles

WRITING PROGRAMS

One of the most fundamental questions we ask ourselves when designing any course will always be: what can I expect my students to already know on Day 1? Answering the question about prior knowledge is more complex when it comes to teaching writing and communication, but research suggests that biology instructors benefit from having explicit information about students' prior knowledge about communication and actively working to build on that knowledge (20). Research shows that faculty often take for granted that the knowledge, skills, and habits of mind that students have developed as writers and speakers in prior coursework will easily and automatically transfer into their work inside new contexts, including new disciplinary contexts. This common assumption of automatic transfer has been proven wrong by education researchers for over a century (21), and knowledge about communication is no exception. Recent studies of transfer of knowledge about

academic writing show that it is neither automatic nor simple and that transfer should be actively facilitated by teachers at both ends of the transfer (22–24). One step teachers can take to establish reasonable expectations of their students' writing and communication skills is to explicitly discuss their prior experiences as writers with them or ask them to respond to a survey on that topic prior to the start of the course. You might consider seeking the following information from your students:

- Does the student have prior instruction about or experience with a particular genre of academic writing that will be featured in this course?
- What are the student's self-assessed writing and communication strengths and limits?
- What goal(s) do students have for themselves as communicators in their field?
- What writing skills do students value and/or expect to use in their future careers?

These questions and student responses may also be useful in guiding course design. For example, a survey may reveal that students are not familiar with the lab report genre or, more likely, that they do not appreciate the parallels between a lab report and a scientific journal article. In this case, the instructor might choose to build in time in the syllabus for explicit discussion of the importance of a lab report as practice for future communication in the field's accepted discourse (11).

In addition to talking with and surveying your students about what they know regarding academic communication, we encourage biology instructors to reach out to directors of campus writing programs to learn more about those programs' goals and approach to teaching communication. Here, we use "writing program" to refer to an organized curriculum designed to teach writing to undergraduates, most commonly administered in an independent writing department or an English department. The National Census of Writing reports that 96% of four-year colleges in the United States have a first-year writing requirement, the hallmark of most writing programs, and most campuses designate a writing program director who oversees these courses. These directors are most likely located within an English or rhetoric and composition department, though some schools have independent writing programs. Such an overture can do a great deal to surface your own assumptions and prevent failed assignments.

Currently, there are many competing approaches to teaching first-year writing. In some programs, the course may look much like an English course in which students study literary essays and attempt to write such essays themselves. Some programs take a rhetorical approach, teaching students rhetorical theories and asking them to apply them to a set of texts that varies widely by context. Other approaches attempt to teach disciplinary writing from the start, offering students a choice of very different first-year writing courses with varied disciplinary foci and corresponding writing assignments. Some newer approaches, like those based on the pedagogical movement called "writing about writing" and those emphasizing multimodal composition, will be significantly different still. A detailed discussion of these theories is outside the scope of this paper, but those seeking further details can consult Tate *et al.*'s *A Guide to Composition Pedagogies* (25). It is really your local program that will matter to you, so we encourage you to reach out to the directors of this curriculum on your campus with specific questions. We suggest the following:

- What critical reading, writing, and library research skills can I expect my students to have gained in their previous courses?
- What are some important aspects of academic communication these courses are not able to address?
- Do students learn anything specific about academic writing in the sciences in these courses?

- What writing experiences and knowledge might I be expecting my students to already have that they are actually unlikely to have gained from prior coursework?
- What would you recommend I do to help students connect their prior learning about academic communication to the learning they will do in my class?

Going into this conversation, you should be aware that many writing program directors are used to fielding complaints from colleagues that "our students can't write" and being asked to account for students' failures. The fact that first-year writing courses tend to frustrate many stakeholders is well understood by those who direct these programs (26). The reality these directors confront is that no course can directly prepare a student to write the grant proposal the biologist assigns, the public policy white paper a political scientist assigns, the artist's statement that a studio art professor assigns—the list goes on. Students often appear not to be able to write because they have not yet been introduced to a particular genre of writing, the intellectual situation that calls for that writing, and the audience that reads such texts. So, in entering this conversation with these colleagues, we advise that you begin in a positive way, making clear that you are interested in ensuring your teaching builds successfully on their work with students.

Understanding your students' existing knowledge of academic communication yields direct benefits for your teaching. It enables you to design a writing assignment that is challenging but not overwhelming. It gives you access to students' vocabulary for discussing academic communication, so you can build on key concepts they know and introduce new ideas in a way that will make sense. It also helps you anticipate what kinds of instruction or scaffolding students may need to successfully complete an assignment. Finally, it will aid in establishing a clear, fair rubric or grading standards for the work. Overall, knowing what your students know about academic writing can help prevent a failed assignment that frustrates both instructor and students.

WRITING CENTERS

Even when you have designed an assignment that is well-tailored to your learning goals and your students' knowledge of academic writing, you still face the challenge of bringing students through the process of successfully completing the assignment. In this task, collaboration with a campus writing center can be a great asset. Writing centers are traditionally student-facing organizations that aim to help writers navigate varied writing tasks. They help students primarily through one-to-one tutoring, though in most cases, this is not the sole resource they offer. And while writing centers happily help your struggling students, their mission is almost always to help *all* writers improve their work.

One of the foundational texts in writing center studies, cited in nearly one-third of articles in the field's flagship

journal (27), is Stephen North's "The Idea of a Writing Center" (28). North contends that many of his colleagues misunderstand the writing center's mission and attempts to clarify the key principles than animate most centers. The most common misconception about writing centers is that they are editing services focused on grammar and citation. This thinking leads faculty to send students to the writing center when their writing has significant sentence-level errors in order to have it "fixed." Few writing centers take an editing approach, however. As North put it, "our job is to produce better writers, not better writing" (28). The vast majority of writing centers are guided by this active-learning orientation. In other words, writing center tutorial sessions typically seek to engage students in supportive, dynamic conversations so that students can improve their own writing.

This does not mean a writing center tutor will not point out or explain how to correct a particular error in a paper. Rather, it means that the emphasis of the conversation is on teaching rather than editing. Even a successful tutorial session may leave many problems "unfixed," with the expectation that writers apply learning from the session to revise their own work, and, when appropriate, that writers return for subsequent discussions. Most writing centers also emphasize the agency of the writer, asking writers to set the agenda for the conversation, which may mean that areas of a text that the tutor knows need work are not the focus of conversation. Many tutors will direct the writer's focus toward "higher-order concerns" like organization, understanding and addressing an intended audience, and the presentation of argument before attending to "lower-order concerns" like grammar and clarity. Each writing center will have a different philosophy and corresponding training about how "directive" or "non-directive" tutors should be.

Other misconceptions exist about writing center staff. Some faculty assume the tutors know everything about writing in all fields, while others assume they know little beyond basic grammar rules. The reality is that staffing of writing centers varies a great deal, and these differences affect the kinds of support they offer. Writing centers may exclusively employ peer undergraduate tutors, graduate student tutors, or professional tutors; many employ a mix of all three. In terms of disciplinary training, some centers are staffed entirely by tutors with majors or degrees in English or writing, while others employ tutors from a wide variety of disciplinary backgrounds, including social scientists and scientists. There is a long history in writing centers of viewing tutors as generalists who are trained broadly in academic discourse and prepared to respond meaningfully to any kind of academic writing. However, there is increasing acknowledgement that tutors can do more for writers when they understand the content, methods, and goals of the discipline of the writing (29). We advise that you inquire about the level, disciplinary background, and training of the staff at your center and set your own and your students' expectations accordingly. You might consider offering, if you are willing, to be part of helping to train the center's staff

for working with writers in biology and with your students in particular.

Many writing centers do more than tutor. They may offer original resources on their websites and hold workshops and presentations for students in their centers. Some centers collaborate with faculty to develop materials or workshops tied to a specific class. Another common resource housed in writing centers is a "writing fellows" program, which embeds highly trained tutors into specific courses so that the tutor can help support the writers in that particular class. Writing center directors and staff are typically keen, as resources allow, to develop new programs and workshops in response to student or faculty need. Thus, we encourage you to talk with a writing center director not only about the center's approach to tutoring, but also about the other resources they have, or can develop, for your students.

CONCLUSION

While every university and college is unique, we have sought to characterize the most common campus resources that will be of use to biologists incorporating writing and communication into their teaching. Some campuses may lack one or more of these resources, while others may have resources beyond those described here. Though it takes some initial effort to make these inquiries and build new relationships outside your department, over time these collaborations are very likely to save you time and energy. More importantly, they will help us produce a generation of biologists who are keen critical readers, clear writers, and compelling speakers.

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