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"WHAT'S COOL HERE?"

Collaboratively Learning Genre in Biology

Anne Ellen Geller

I ran into David Hibbett at a convocation reception a year after we had collaborated on writing workshops for his Biology of Symbiosis class. Over cheese and crackers, surrounded by a throng of noisy faculty catching up on one another's summers, David, a mycologist in the Clark University biology department, revealed that he was in the throes of writing a *News and Views* column for *Nature*, a commentary based on a primary research article in the same journal. The column is smaller in scope than the "mini-reviews" David had asked his symbiosis students to write, pieces that survey and comment on the research in a subdiscipline. But writing and revising his own work left David remembering the questions his students had faced a year earlier as they had written their mini-reviews. That is, he needed, and wanted, his writing to be accessible to a general audience who might not know the fungi he knew well, and he needed to stress what made the fungal/plant associations he was writing about distinctive—what made them "cool." David was striving to engage his readers, even those who might not expect to be interested in, or able to understand, his subject.

David's *News and Views* column was published just a few weeks after we spoke. It has a clever title: "Plant-Fungal Interactions: When Good Relationships Go Bad" (Hibbett 2002). He practices what his students told me he preaches—that articles should have titles that will intrigue readers. In the first lines I find out that I will learn how "some non-photosynthetic plants cheat their fungal partners" (345). I am enticed. I have to read on, even though I know nothing about mycorrhizae, the "ancient, widespread associations between fungi and the roots of many species of plants" (345). I am one of the literate laypeople David envisions as his audience, and I become interested in fungi because his language invites me into a world I know nothing about.

As a scientist David thinks about the power of mutually beneficial symbiotic relationships. He also cares deeply about how scientists can

form better relationships with those outside their area of expertise. He has made me realize how much scientists depend on those outside their laboratories for support, financial and otherwise, and support comes only when those outside the work of a laboratory—other scientists and nonscientists alike—can understand the work inside the laboratory. David wants his students to realize this, too. Like other research scientists, he writes and encourages students to write and coauthor primary research articles about the work of his lab. But he also always seems to ask: what other genres can scientists use to communicate scientific work on complex topics to the lay reader? And how can science students learn to write in these genres so they can learn how to show a nonscientist what is "cool" about their work, no matter how specialized it is?

In the fall of 2001, Biology of Symbiosis was not a writing course; it was an upper-level seminar for sophomores, juniors, seniors, and a few graduate students. David was under no university mandate to "teach" writing. However, in a course where developing deep understandings of symbiotic relationships and synthesizing bodies of research about those symbiotic relationships were integral to his goals for the course, David saw writing, the writing of mini-reviews in particular, as integral to his students' learning.

Mini-reviews, most familiar to scientists but published in a variety of disciplines, are short articles that summarize and comment on the most recent scholarship within a narrow subdiscipline. Writers of mini-reviews must know their subject incredibly well, well enough to make judgments about current research in that field. So mini-reviews also teach science students how deeply and thoroughly one must understand a subject to write about it clearly and elegantly. The assignment was particularly well suited to this upper-level seminar, in which students could be expected, after their library orientation, to independently gather research from sophisticated and respected scientific journals.

David and I held only two workshops together, yet what we—David and his students and I—learned from those sessions was significant. His students—majoring in biology, biochemistry, molecular biology, and environmental science—seemed to have had very little experience in thinking about how to communicate their science to nonspecialists. Most knew how to write science only in the genres they had been taught: lab reports, essay questions, and case studies. Some had completed creative science projects meant to encourage writing to learn. Almost all, it seemed, had completed some form of research paper in the social sciences or humanities.

What I now understand is that for David's students to be able to successfully produce a mini-review, a new genre for them, they had to be able to tell themselves what distinguished it from other genres in which they had written.

From their previous writing experiences, David's students had:

- an understanding that writers must gather evidence
- some knowledge of how to employ a thesis, controlling idea, or question
- a basic understanding that the parts of a text must relate to the whole of a text
- a superficial understanding of audience

But to write a mini-review, David's students had to:

- know their subject *and* know how to convey their knowledge with authority
- find a central, organizing idea or question sophisticated enough to be of scientific interest, but uncomplicated enough to engage nonspecialist readers
- feel comfortable synthesizing, organizing, and analyzing a great deal of evidence
- be aware of audience and translate specialized information to a nonspecialist audience

David himself certainly had experience moving among genres, publishing the *News and Views* piece in the same year he published three primary research articles. Yet what he didn't realize was that he had internalized the writing strategies he used to negotiate the differences among genres. He knew, for example, how writing to nonspecialists was different from writing to specialists. He knew how to reduce jargon and simplify concepts, even when the science was complicated, and he knew how to structure a short, complex text by what makes it "cool." But it wasn't until the writing workshops that David could articulate the central motive for writing a mini-review. In a mini-review, a professional scientist has a sense of "what's cool" and can advance his or her own scientific agenda. David's goal was not just that students learn to write a new genre. He also hoped his students, less experienced scientists, would learn to take on the interested stance of the professional scientist. He hoped that the mini-review itself would be "cool," a complex, hybrid genre that would push students to think through their roles as scientists, readers, and writers. In the end, the craft of learning to teach the genre of the mini-review was almost as

complicated for David as the craft of writing the genre was for his students. Yet it was as satisfying for David (and for me) to learn to teach the genre as it was for his students to learn to write it.

In this chapter, I want to consider the relationship between the structure and goals of Biology of Symbiosis and the mini-review assignment, for I believe it was the collaborative environment of David's classroom that made negotiation of genre a possibility. Then, I'll consider the mini-review assignment and its relationship to students' previous writing experiences. Finally, I'll describe the writing workshops David and I held with his students and explain what they revealed about David' teaching goals, his students' struggles, the genre of the mini-review, and David's deep understanding of the mini-review. Throughout, I will include excerpts from David's class materials, as well as excerpts from conversations with him and two of the students in his class, Caitlin Dwyer-Huppert and Ewa Zadykowicz. I will include writing from these same two students.

BIOLOGY 256: BIOLOGY OF SYMBIOSIS

> I am offering this course because I want to learn more about symbiosis and share what I have learned with you. This is the same attitude that I expect you to bring to the course.
>
> —Biology of Symbiosis Syllabus, 2001

Over the first weeks of the semester, David lectured and led discussions on selected symbiotic relationships—relationships in which two or more species live in intimate association—and on the general evolutionary theory of symbioses. Students took a short-answer quiz on that course material. But then the course format changed. David's expectations were clear. From that point on, each class would be planned by a student. Each student would be responsible for choosing a symbiotic relationship and presenting it to the class. No matter what symbiosis the presenter chose, and no matter what aspect of the symbiosis the presenter emphasized, he or she would be responsible for assigning readings from the text to introduce the symbiosis and he or she would also select one or two peer-reviewed primary research papers and assign these. Thinking back on the semester after it ended, David said he had intended to give himself a bit of a break by turning much of the course over to his students. His students, however, saw the change in course structure as an opportunity to take greater responsibility for their own learning, and once they took

that responsibility, they began to practice the expert stance they would need to have in their mini-reviews.

From the first day of class, when the syllabus was distributed, students also knew a discussion leader would be chosen at the beginning of each class. The gravity of that assignment of responsibility did not strike me until Caitlin Dwyer-Huppert explained: "We would all read the papers for class, and we were *all* accountable for understanding them as best we could and being prepared to talk about them because David chose a name out of a hat and whoever he chose had to lead discussion of that day's paper." This led to what Caitlin termed "accountability." Students could not, and did not, slack off; they had committed to being prepared for every class, and as Ewa said, they never knew until the moment the name was drawn who would be held most responsible.

This was not unlike the accountability David had created for himself. As he said in his syllabus, David was not knowledgeable about every symbiotic relationship they would study. While he did approve the papers students chose to present before they prepared presentations, and he clearly had more knowledge of symbiosis than the students, he was sometimes just as likely as his students to encounter the week's symbiosis for the first time when reading and preparing for class. Caitlin told me she remembered days when "David seemed to have as many questions about a paper as we did as we all tried to understand it." To her, this meant that he was as engaged as his students were in learning. He was exploring new material with them. This, too, kept them committed.

To Caitlin it was even significant that David asked students to sit in a circle in class. David laughed when I told him this. "It was just so we could see one another as we talked," he said. But the spatial organization of the room set the intellectual tone of the class. Ewa remembered in-class discussions fondly, saying, "When you have a lot of people working together, the group becomes much more intelligent than any individual would ever be and together there is a feedback loop. You end up thinking about things you wouldn't have thought of yourself and you start making yourself think in different ways than you used to." It was the workshops, I think, that helped David realize what a powerfully collaborative scientific community he had created in class. Originally, he hadn't been sure he'd be comfortable in writing workshops. He'd never held a writing workshop for his students. But reflecting on them once they were over, he said the workshops had surprised him; they reminded him of "lab meetings," times when all who work in a lab get together with the PI (principal investigator)

to talk about and negotiate projects, experiments, successes, challenges, and pending publications. Interestingly, it was attending lab meetings just like those David describes that Christina Haas, who followed one biology student over four years, termed "mentoring in a socio-cultural setting," a type of discipline-specific mentoring she found very important (1994, 77) to that student's rhetorical development. I'm not sure that David knew his students appreciated the collaborative, inquiry-based atmosphere of his class long before and long after the writing workshops ended. I didn't know it until I began to talk with Caitlin and Ewa.

Most significantly, David Hibbett asked his students to invest in new ways of learning over the entire semester. Students' in-class experience scaffolded their writing, and thus, their writing made sense to them in the context of their in-class experience. We too often forget how necessary it is to relate in-class learning to the writing done outside class. We may assign new genres to be completed outside of class, but those assignments may necessitate changing in-class instruction, for in-class instruction can lead students to rely on familiar writing strategies even when facing new genres, or can encourage students to take on the challenge of new genres with all their inherent tensions. In "The Life of Genre, the Life in the Classroom," Charles Bazerman notes that "our strategic choice of genres to bring into the classroom can help introduce students into new realms of discourse just beyond the edge of their current linguistic habit," but it may also be up to "us as teachers to activate the dynamics of the classroom so as to make the genres we assign come alive in the meaningful communications of the classroom" (1997, 24). With that in mind I turn to how the mini-reviews David asked his students to write kept them working just beyond the edge of the linguistic habits they relied on as science students, just as the in-class work they practiced together did.

BIOLOGY OF SYMBIOSIS MINI-REVIEWS

> I remember thinking how can I write this in a way that it is really understandable. I remember other people struggling with that too. Being forced to do that is what really allows you to internalize and understand something.
>
> —Caitlin Dwyer-Huppert

A few weeks before the class format changed, David invited Clark's Goddard Library reference staff to talk about strategies for researching scientific papers. David wanted his symbiosis students to become sophisticated researchers of published scientific texts, researchers who could

identify quality research and would know a peer-reviewed article when they saw one. But David also told me he used the librarians' visit as an opportunity to discuss how to "find, read, evaluate, and explain" a scientific research paper. In fact, his syllabus committed him to taking "time to discuss the anatomy of a scientific research paper, the process of publishing in science, and the difference between reviewed and nonreviewed publications." Students would need to know all of this for the research they would eventually do for their mini-reviews.

In a sense, students' mini-reviews served as a test of what they had learned about choosing quality primary research articles and reading them well. In addition, David wanted to emphasize how readers, how scientists reading their peers' work, respond to scientific writing. As they researched, David's students knew to think of themselves as critics, hungry for information but also slightly resistant, full of questions. I would now suggest to David that he make this more explicit to his students, though I think most students understood that he expected them to think about how successful the primary research articles were as they were reading and presenting them. Teaching his symbiosis students how to research and read primary research articles, David prepared them to write mini-reviews. Teaching them how to write mini-reviews—a genre new to most of them—he strengthened their researching and reading as well as their understanding of course content.

There were two times during the semester when Biology of Symbiosis students were required to write mini-reviews. One mini-review focused on the subject a student covered in an in-class presentation; the other mini-review could be on a second symbiosis of a student's choosing. Depending on the content of a mini-review and on who is writing it and on where it will appear, it may take on very different forms and styles. David has explained to me that published mini-reviews in journals such as *Science*, *Nature*, and *Cell*, and in more specialized journals such as *Trends in Ecology* and *Evolution* can be "very influential," for they are "authoritative and critical," yet they are highly "accessible." Greg Myers (1990) argues that "such articles may not directly advance the career of the individual writer" but "are essential to the survival of the discipline, dependent as it is on public support for research" (145). David disagrees, noting that because reviews are often well cited, they bring a scientist's opinions to a broad audience.

In his mini-review assignment, David suggested a fairly rigid textual structure. "In your introduction, describe the system and explain its

relevance to general issues in the study of symbiosis. Later, briefly recap the major research initiatives in the area, and review their successes and failures. Conclude with a perspective regarding the state of the field, perhaps suggesting new experimental approaches that could resolve remaining questions." The assignment made a mini-review seem quite straightforward. To me, David seemed to be offering a template, but later he would say that all he thought he was offering were "the basic elements of any scientific paper." While David knew the ways in which all scientific papers are alike and different from one another, he did not, or could not, articulate these until the writing workshops.

David's assignment did strongly encourage student writers to pay careful attention to their audience, an audience of nonspecialists. In class he reiterated that a literate layperson needed to be able to understand the complicated symbiotic relationships explored in the mini-reviews. In his assignment, he suggested students "avoid jargon, define essential scientific terms, and clearly describe experimental methods" of any studies reviewed.

As David has taught me, mini-reviews are not meant to collect all that is known about a subject. A mini-review's bibliography need not cover every publication related to the subject. David told me a mini-review should "highlight the critical issues in an area of research, expose the assumptions and limitations of current approaches, and suggest promising avenues for further inquiry." Because most readers of a mini-review will not be familiar with the particular subject—whether or not they are scientists—a mini-review writer should explain "the general motivation and broad relevance of research in whatever area is being discussed." Just to add to the challenges of writing such a text, the best mini-reviews, according to David, "include a novel synthesis and new ideas." This seems to be what challenged Biology of Symbiosis writers most. New to the symbiotic relationships they were writing about, and new to the role of scientific expert, student writers struggled to find their authority in relation to the scientific research they incorporated into their mini-reviews.

David's written assignment did note that a mini-review should be a "critical summary" of the major issues of "an active area of research," and the phrase "critical summary" proved to be an interesting one for students to unpack. As Judith Langer notes, when faculty "talk about thinking," we sometimes fall "short of the kinds of explication that would convey disciplinary argumentation" and "structures" (1992, 78, 80) to students. Langer argues, "While the forms of comparisons, critiques, or

summaries can be discussed in general ways, if only the general characteristics are discussed, then the use of those forms in particular disciplinary contexts will be lost" (85). Langer also says that we "need to look beyond generic terminology about thinking and reasoning" and find more "specific vocabulary to use in discussion with students" (85). As the description of the workshops will reveal, David did come to a much more specific articulation of what it meant to him for a scientist writing a mini-review to summarize critically.

Students knew they would need to account for a body of scientific research; they knew to summarize and present current research, but they didn't know how to set primary research studies in conversation with one another. They knew they were expected to make judgments about current scientific approaches to the symbioses they studied, but as novices they felt unprepared to do so. This is the writing work they learned to do as they wrote their mini-reviews and as they revisited them in the workshops.

Most of the students in Biology of Symbiosis had never written anything like a mini-review, especially for a science class. Joy Marsella (1992) suggests that students "consider what they know about their professor's expectations in such areas as format, structure, and appropriate sources of information" when they write to an assignment, yet "many, perhaps most, of their decisions are driven less by their reading of the teacher's expectations than by their own prior experience as writers and by the present contexts of their lives" (178). I was left wondering what prior academic writing experiences inside and outside of science David's students drew upon when faced with this new genre.

Students' answers are revealing; both Caitlin and Ewa did draw on prior experiences of academic writing and both tried to adapt what they knew to this new genre. In doing so, both had to face questions raised for them by David's mini-review assignment. Was the mini-review creative writing because it was writing for a nonspecialist audience? Should the mini-review focus on some controversial aspect of science to appeal to a more general readership? Should the most complicated aspects of the symbioses simply be left out because readers might not understand them? How expansively should one attempt to cover the symbiosis? How many specifics of the research should be included? Caitlin and Ewa's negotiations with their prior academic writing experiences preview much of what all the symbiosis students raised in the workshops.

When I asked Caitlin what she had written in other science classes, she had few writing experiences to describe. She was more interested in

telling me about in-depth projects she had taken on in history and sociology. In fact, no matter how scientific the topic of a mini-review may be, mini-reviews may at first appear to students to be more like the research papers they write in humanities and social science courses, simply because they seem less like what most have written in science.

The introductory chemistry and biology classes Caitlin had taken required only short answers on exams, and though she felt those short answers had led her to practice writing out her understanding of processes as she studied them, they never required extended analysis. Lab reports, written in almost all of her science classes, felt "canned." As she said, she "pretty much knew the whole abstract, introduction, blah, blah, blah." Caitlin felt she had one previous science writing experience that came close to the type of writing David was requiring. In an evolutionary biology class she had written a story in a "Dr. Seuss style" to explain how a fantastic population had evolved. She saw both that story and the mini-review as the types of assignments developed by faculty who are interested in writing and the creativity possible within the teaching and learning of science. Yet she felt the story assignment was still very different from the mini-review. The story was "fun" and "creative," and she felt it was meant to be. She remembered it was due just before the December break, when she and the other students welcomed the opportunity to play.

For Caitlin, the mini-reviews were about "research, bringing together different sources, and going with some kind of idea." In addition she felt students in Biology of Symbiosis were "learning to be familiar with how scientific papers are written," synthesis, and something she named *craft*. For Caitlin, craft was "about using language." Through "grappling with what was appropriate" in the language she used in her mini-reviews, she was left feeling as if she were *crafting* them.

In his comments on Caitlin's first mini-review, David noted that some of her language was "florid." Without looking back at her writing, that was a word Caitlin remembered him using. She "had a really hard time with that" comment, because while she worked to "tone down" her language, she told me she "couldn't divorce myself from what I found fascinating" and she wanted to write in a way that would reveal "how magical things were" to her. Here is the first paragraph of her first mini-review.

> In the cold, montane environments of the western U.S. wingless seeds of the Whitebark pine (Pinus albicaulus) lie locked in their cones, waiting for the beak of the Clark's nutcracker (Nucifraga columbiana) to shred the fibers and

> peck them from the dark. Unlike most pines, the cones of this species do not open at maturity to liberate the seeds. This pine cannot reproduce without the help of Clark's nutcracker. The nutcracker, in turn, depends on the pine's nutritious seeds as its main food source (Tomback 1982). This paper will examine the mechanisms that perpetuate this mutualism, its evolutionary origins, and profound effects on the surrounding ecosystem.

In those first lines of her mini-review, Caitlin confidently sets a scene and beautifully describes the symbiotic relationship's players—pine and bird. But when she reaches the final line of the paragraph, she does not express a novel synthesis; she offers only a description of what the mini-review will "examine." She was unable to transfer her fascination to her readers through anything but description. Her language play alone does not convey an argument or a reason to care about the symbiosis.

Caitlin struggled with this in her second mini-review as well, but after the writing workshop, she did move closer to articulating a central idea. What Caitlin may have begun to learn in the writing workshop and through David's comments on her mini-reviews is that language choice is not the only way for a scientist to express fascination with a subject. "Honeybees themselves are proposed to negatively affect the populations of native pollinator species. This paper will address the impact of fragmentation on honeybee and native bee populations. It will then explore the extent to which honeybees disrupt native pollination systems."

When she wrote that second mini-review, late in the semester, Caitlin was still uncomfortable with her expert knowledge. "What could those impacts be?" David wrote in the margin, prompting her to say what he believed she knew. "Some complex ideas here," he wrote in his final comment. "It would have been helpful to synthesize the hypotheses addressed in the different studies. Perhaps in the introduction?" Even as a senior, Caitlin needed to learn to find a central, organizing idea sophisticated enough to be of scientific interest to her readers. She also needed to learn to articulate that idea in the beginning of her text and use it to organize the whole of the text.

Ewa Zadykowicz, who was a sophomore the fall she took Biology of Symbiosis, had taken few other upper-level courses, and she felt that she had had only one writing experience that was at all comparable to the mini-review. In a class on environmental hazards, she had written a case study on the Woburn, Massachusetts, leukemia cluster described in Jonathan Harr's book, *A Civil Action*. To complete her case study she had

been required to read beyond the required text, *A Civil Action*, gather research, and make sense of many conflicting scientific opinions. Yet it seemed different from the mini-reviews because to her it was "more controversial and socially pertinent" than the symbioses of the mini-reviews.

What Ewa thought was similar about the two projects was that she was reminded that "there are always a lot of arguments going on in science, and it's difficult to pick out the important points. To do that you have to be able to take a lot of notes and organize them and then figure out what's important." She didn't enjoy dealing with the politics of her case study, but she did enjoy the mini-reviews, which were not "socially controversial per se" and through which she could focus on the ecology of systems, her interest. Because Ewa was a sophomore, the mini-reviews were Ewa's first experience of scientific research—"going through a huge body of other peoples' research, analyzing it," and coming up with her own conclusions about it. This was something she had practiced in her case study, but the materials she researched for that project were less scientific and the actual text she produced was longer. It was a challenge for Ewa to determine how to synthesize all the information she gathered for her mini-reviews and present it to her imagined audience. "I have problems clearly presenting scientific information to an educated layperson because there is a lot of information, background information, and I'm not sure if the readers need it or not so I either make my sentences clear but complex, scientifically dense, or I try to make them more understandable to a regular reader, but that makes them longer and more complex and, in a way, less understandable."

David made comments on both of Ewa's mini-reviews related to this issue: "avoid excessive use of parenthetical comments" and "too technical." Ewa willingly immersed herself in the science of the symbiotic relationships she wrote about, but because she had little experience writing for real readers she struggled to choose which details to convey. Yet Ewa's writing changed significantly in her second mini-review. As I'll explain in the next section on the writing workshops, this had as much to do with the process modeled in the workshops as it did with the writing skills modeled.

BIOLOGY OF SYMBIOSIS WRITING WORKSHOPS

> [The workshops] helped me realize that I often approach topics in a broad way and want to include too much! I need to hone in on one area and really

> explore its issues. . . . I love seeing how others write, how their minds deal with the challenge of presenting material.
>
> —Anonymous Workshop Evaluation from Biology of Symbiosis

The two workshops David and I held took place in a wonderful seminar room in the science building where all four walls are lined with half bookshelves. Six students signed up for each workshop so David, the students, and I were able to sit comfortably around a rectangular table and see one another as we talked.

David had already graded the mini-reviews and returned them to students, but he had copied them for himself, and he had gone back over them with red pen, noting what he might raise in the workshops. As he had responded to students, he had looked for what each mini-review would be about, but he had found few articulations of writers' overarching ideas or analyses. He wrote comments such as "Tantalizing, but what are we talking about?" and "Make the case up front" and "Is this the question?" on their mini-reviews. He had a sense that where and how students began their mini-reviews was crucial to the mini-review's success, but I don't think he knew quite how to articulate this to his students until the workshops.

What I don't see in David's notes in preparation for the workshops is what he eventually ended up articulating to his students, something central to his mini-review assignment but missing from the actual assignment, something that I see as central to his rationale for teaching students to write mini-reviews. What he told his students in the workshops was that writing decisions in something as complex and as compact as a mini-review are dictated by what a scientist-writer finds most "cool." When "what's cool" is identified, all writing decisions can be made through that lens. It's difficult enough as a disciplinary novice to make a solid intellectual claim when submerged in a vast sea of research, but mini-reviews also require writers to make the claim accessible to readers unfamiliar with the specialized research, a task much more difficult than David's assignment guidelines might have suggested.

For David, "what's cool" is the solid intellectual claim a writer makes in a mini-review. That solid intellectual claim, which is what Gordon Harvey names "motive," is what helps a writer sort through the vast amount of research he or she has collected and articulate "why it should interest a real person . . . : why it isn't simply obvious, why there's a mystery to unfold, how the matter is different from what one might expect or some

have said" (1994, 650). For Harvey, that "sense of motive needs to be sustained through the essay, but establishing it is the essential work of the sentences we usually call the introduction" (650). However, the establishment of motive may itself be a process of discovery for a science writer.

In "Scientific Composing Processes: How Eminent Scientists Write Journal Articles," Jone Rymer reports that seven of the nine scientists who participated in her study "readily acknowledged that they discover new aspects about the scientific information while writing their papers" (1988, 238) and, as one told her, "'I'm pretty interested in [publishing my data], pretty excited about it because there's no point in publishing it unless you find it interesting'" (220). This reveals, as Rymer notes in her conclusion, "that scientists are tellers of tales, creative writers who make meaning and who choose the ways they go about doing so" (244).

In fact, Greg Myers proposes that not only do those who write review articles in the sciences choose the "story" (1991, 52) they want to develop to "enlist readers in a particular view of the present and future of the field" (64), but that the story the review writer highlights and the style the writer chooses to use for the review both have something to do with how well cited the review becomes. As Myers notes, when a specialist writes for nonspecialist readers, he or "she sees it from outside, with these readers, and has to ask the always risky question, 'So what?'" (46). This creates a relationship between the writer and the topic, for "the discovery of this broad audience is also a rediscovery of the topic" (46).

Although the very beginning of Caitlin's "Beaks and Seeds: The Mutualism of Clark's Nutcracker and Whitebark Pine" does not set up the mini-review's story, and Caitlin's first paragraph suggested only this—"This pine cannot reproduce without the help of Clark's nutcracker. The nutcracker, in turn, depends on the pine's nutritious seeds as its main food source"—there was a tale that ran through the first few pages of the review. What fascinated Caitlin was how the nutcrackers remember the locations of their cached seeds and return to their caches by using "landmarks like compass bearings." Two years after writing the mini-review she still remembered this and wanted to tell me about it. And on the fourth page of her mini-review Caitlin refers to the nutcracker's memory capacity as "astounding." I don't believe her word choice was arbitrary. I don't think Caitlin knew her mini-review could so explicitly articulate just what it was she found astounding. In fact, I don't think the symbiosis writers realized that mini-reviews would allow them to tell tales to get at meaning, or would allow them to reveal what they thought was

"cool," until David was able to explain to them why that is just what the genre requires.

As the director of the writing program, when I begin collaborating with faculty in the disciplines, I ask two questions: What do you think your students already know how to do in their writing? What do you wish your students were able to do in their writing that you don't think comes easily to them? The answers to those questions guide me as I decide what I can and should offer as we work together. David had already thought through how his written assignments for the course—two mini-reviews—might lead his students to consider the importance of being familiar enough with primary literature to synthesize it, but he told me he was also interested in teaching students to "have compassion" for readers as they wrote. David felt students, especially science students, seldom wrote "from the perspective of the reader" or "considered readers' expectations." For him, the best example of this was students whose paragraphs were long and unwieldy, allowing no break for the reader. I am now not so sure that long paragraphs were all he was referring to when he described writing from the perspective of the reader.

I know that we came to the idea of holding workshops between the first and second mini-reviews because we wanted to remind student writers that they, too, were readers who had to be satisfied. But David has reminded me he was also interested in having his students imagine one another as their audience, for he felt they would have an understanding of the "expectations and needs of their peers" and would thus write with greater clarity. Beyond that, he wanted students to realize "what will be 'cool' to one reader may not be 'cool' to another." He wanted his mini-review writers to identify with their readers in hopes they might then identify what would be "cool" to those readers. In this way, the workshops enacted one of the goals of the mini-reviews. Students were supposed to think of general readers as their audience, and while in-class peers may have had some sense of the science a mini-review writer was describing, they were, by no means, the same expert audience David was. By encouraging students to anticipate the workshops as they wrote their mini-reviews, David also reminded them to write for their readers.

There was also a practical reason we decided on workshops, rather than on prewriting assignments or group work around drafts—other possibilities I might have suggested for helping students negotiate the genre of the mini-review. David saw his syllabus as a "contract." We couldn't add on

new required work, but we could offer an "experimental" (David's word) and optional experience with writing. David titled the workshops Writing from the Reader's Perspective, described them, and asked for volunteers when he distributed the detailed assignment for the mini-reviews. The workshops would take place after students wrote their first mini-reviews and before they wrote their second. David stressed how useful the workshop experience might be for students when they drafted their second mini-reviews later in the semester.

Preparing for the workshops, it turned out, was more of a test of my expertise than I had expected. In what one of my colleagues has taken to calling my "grassroots" WAC/WID work with faculty at Clark, I had already stepped into co-teaching in a number of disciplines that I had never taken a class in—sociology, psychology, and screen studies. But the truth is those were all classes in the humanities and social sciences, my own background. In my own education I've avoided the lab sciences. When I opened the envelope that contained the students' mini-reviews, I had a terrible feeling I was finally in way over my head.

These texts were about stickleback fish and cestode parasites, tubeworms and hydrothermal vents, and sea slugs and plastids. They described complicated symbioses in great detail. The writers used words I had never heard, and although they were words I knew I might find in the dictionary, especially the heavy, unabridged dictionary that sits on the shelf in the writing center, I couldn't imagine laboriously working my way through the mini-reviews. I felt guilty. So I convinced myself I could read them, if I read them slowly.

Once I allowed myself to take guesses about some words in context, and ignore other descriptions of scientific processes I didn't understand, I actually began to enjoy the mini-reviews. Many of them were quite detailed and used colorful language. Some described symbiotic relationships I might notice around me were I to become more aware. One mini-review, for example, which still fascinates me, was about cowbirds, birds that take over other birds' nests for their own young. In one of the workshops, David joked about how his daughter was both fascinated and horrified by the same symbiosis. As he said, she seemed to wonder if someone could come to her house and do the same to her. What a wonderful moment, I think to myself now, in which David modeled what was "cool" to his daughter about that symbiosis.

When I let myself relax, I could see I was indeed just the educated, nonspecialist reader David had imagined for his students. But that was

not all I was. I was also supposed to be co-teacher as David and I co-led the workshops, and the morning of the first workshop I still felt nervous. I wrote to David and reminded him I had very little science experience. "This is challenging work for me," I admitted in the e-mail. "The genre of these texts is so new to me—I am truly the unknowledgeable reader, and thus I worry that the texts I find more satisfying (meeting my expectations) may not be the ones you would find satisfying." In his response, David reminded me the students were supposed to be writing for readers like me. He wrote, "One of my general criticisms is that the students too often used technical jargon without explanation, or failed to convey the general motivation for studying the system in the first place. So I think that our expectations about the form of the essays are probably similar."

In the same e-mail I listed how I would rate the mini-reviews I had read on a spectrum of "most satisfying to least satisfying," asking self-consciously, "does that jive at all with your reading?" "Your ranking matches mine almost exactly," David wrote back, listing the grades. What he and I agreed on was that the most satisfying mini-reviews were engagingly descriptive. They described the symbiosis with detail that helped the reader to picture it. They minimized jargon and did not rely on citations in every single sentence. When I look at those we were less satisfied by, I see overcomplicated descriptions of organisms and symbiotic relationships. I see citation after citation after citation. Some of the mini-reviews I found least satisfying had very, very long paragraphs.

The mini-review writers did not know what experts David was asking them to be. They did not realize they could turn their readers' focus anywhere they chose. They did not fully understand that they were working as translators and that they were meant to confidently lead their readers through specialized subjects with familiar language.

David and I began each workshop by asking students to brainstorm about these questions:

- What were the goals of this assignment?
- What does this assignment/this type of writing require you to do?
- What did you need to pay attention to in order to have your writing meet the goals of this assignment?

I too was a translator; I wrote the answers students offered on the board with my version of language I heard them use as they described their writing processes and struggles. In both workshops the writers

reported that it was as they wrote their mini-reviews that they realized how much research they had done. "How to condense" came up again and again, but that question remained in conflict with students' accurate understanding that they were responsible for bringing a large body of research together for their readers. "How to evaluate the research," "how to review it with judgment," and "how much background" were questions they all had. They did not feel they knew how to explain the significance of the symbiotic relationship they were describing, or offer—as the assignment had required—"a novel synthesis." They said they found themselves mired in description, even when they knew they needed analysis as much as or more than description. They had considered how they could make their reviews "interesting" and "lively," and they wondered how much "creativity" they could use. Most of all they wondered "what to leave out," "what to exclude." As new experts, everything seemed necessary. They faced simple questions they simply did not understand. For example, why had David told them they could not use graphs and diagrams? Could they use direct quotations? Writing for the designated audience of literate laypeople left the writers asking how to simplify without oversimplifying and how to change scientific jargon to everyday English. They struggled with just what David might have hoped they would struggle with and their explicit articulation of their struggles in the workshops allowed David a way to join the conversation with them.

As we talked, David added to the lists and responded to their questions. It was when students described how difficult it had been for them to make complicated symbioses significant to readers that David described why it is important for writers of mini-reviews to keep in mind: "What's cool?" He raised this a second time when students described struggling with what to include in, or exclude from, their mini-reviews. For David, the best way to make decisions about *how* to structure a mini-review and *what* evidence to use is to decide *what* is "cool," and then determine *how* to make that "cool" for readers. David reminded the student writers of their role—they were disciplinary experts speaking to nonspecialized readers, and they had the authority to decide what to include and what to leave out. Transcribing what I thought were the most important comments he made, I wrote this on the board: "Writer is knowledgeable enough to make this decision. Clarity is more important than completeness. Can't always, and don't always, have to cover everything. New ideas take more time and space."

In each workshop, we considered each student's mini-review one by one. We took a few minutes to jot down thoughts about each

mini-review before we talked about it and then spent ten minutes for each on these two questions: What strategies is the writer using that are working well? Which aren't or which are missing (if any)? There were productive exchanges as we talked about each writer's text and considered which aspects of the writing were succeeding and which were failing in terms of the genre requirements of the mini-review, but what I believe was most worthwhile about each of the workshop hours was the opening conversation David, the students, and I had together. In the give-and-take of workshop conversation, David and his students could develop their shared understanding of the mini-review.

David told his students that their answers to "what is cool" would help them make decisions about *how* to structure their mini-reviews and *what* evidence to use, but there were many other writing decisions to make that forced them to negotiate between how they may have previously written and how they now had to write. Perhaps what becomes important then is how the workshops provided a space where the students, who were not quite disciplinary insiders and not quite disciplinary outsiders, were able to negotiate the demands of the mini-review. As David Russell and Arturo Yañez point out, it is students and teachers alike who need to remember that "writing is never writing period," but "is always . . . part of some system of human activity" and people "act in multiple, interacting systems of activity where writing that seems the 'same' as what one has read or written before is in practice very different—and not only in the formal feature, the 'how' of writing." As Russell and Yañez go on to say, "Lying behind the how are the who, where, when, what and—most importantly—the why of writing, the motives of people engaged in some system of activity" (2003, 359). In the workshops, David and I could certainly offer the symbiosis writers the "how," as in "how to write" a mini-review, but we could also explicitly remind them of the where, when, what, and why of writing mini-reviews. We could remind them the text was more than a template: it was a conversation.

Thinking back on the workshops, David has said that what he appreciated most was the verbal exchange; he had the opportunity to give students feedback in the form of conversation. For David and the students the workshops seemed to offer space to have the same kinds of negotiated and collaborative conversations about writing that students felt they were having about disciplinary content in their in-class discussions. It was once again just as Ewa described, "a feedback loop," where "you start making yourself think in different ways than you used to." We often forget the

power of this type of conversation, perhaps because it is so difficult to fit it into a semester's discipline-specific teaching and learning.

We also underestimate the power of allowing students to see one another's work. Many students noted in their workshop evaluations how powerful and educational it was to see that their classmates were struggling with the same aspects of writing the mini-reviews that they were and how useful it was to see the many different writing strategies their classmates had used in their mini-reviews. It might be more effective to incorporate these workshops into the plan for the semester and hold them before mini-reviews are due. But, as David had hoped, the writing we looked at in the workshops was already quite strong because students had written it to be graded and knew beforehand that their peers as well as David would be reading their mini-reviews.

Ewa's experiences writing her second mini-review reveal what she learned from the writing workshops. I am struck by the significant difference in the beginnings of her two mini-reviews. Ewa chose the topic for her first mini-review because the symbiosis "seemed cool," but in the beginning of that mini-review she could not express her fascination. Like Caitlin she ended up focusing primarily on description. "No clear question or thesis," David wrote back to her. But it is interesting to note that the beginning of her first mini-review follows David's assignment guidelines fairly closely.

> The sea slug Elysia chlorotica depends on the chloroplasts derived from the alga Vaucheria litorea for survival. This mollusk is a specific herbivore and has been shown in the lab to forage for V. litorea— its only food source—exclusively during its larval stage. From then on, the slug relies on photosynthetic material derived from the chloroplasts of V. litorea for a source of organic carbon.
>
> Some would argue that this relationship could not be considered symbiotic, in the traditional sense of the word, since it involves an association between an organism and only part of another organism. Nonetheless, whether one chooses to call it chloroplast symbiosis, chloroplast retention, or kleptoplasty (the stealing of plastids), this association is no less complex than any other more conventional symbiosis (Pierce et al., 1999).

Ewa said she wrote her second mini-review to feel more like "a walk in the woods" because she had been impressed by her classmates' play with language. This second beginning reveals a much greater understanding of the importance of "what's cool." She sets up an argument about the

possible implications of the symbiosis she presents, and while the success of her second mini-review may be partly attributed to the fact that she had previously studied and researched this symbiosis and was therefore able to take on the necessary expert stance more easily, Ewa also said she thought deeply about what she had heard in the workshops. In fact, Ewa has, by her own admission, seldom been a draft writer, so she was proud to tell me that after the workshops she asked two of her classmates if they would read and respond to the draft of her second mini-review before she handed it in to be graded. They agreed. On her own, she carried the message of writing for the reader out of the context of the course and into her own process.

Here are the first two paragraphs of Ewa's second mini-review:

> If you walk through a grove of healthy hemlocks, you will notice that their canopy creates much more shade than the canopies of most other trees that are common in the northeast. In fact, the density of hemlock canopies provides enough shelter to effect a different microclimate underneath the hemlocks. In the winter, the temperature in the immediate area is several degrees Celsius higher than the rest of the environment, while in the summer, hemlocks cool down their surroundings by several degrees. A hundred species of plants alone are known to rely on hemlocks for survival. One of the most well known and valued animals that require shelter of hemlocks for thermoregulation is the brook trout, which could die out if summer temperatures in streams increased (Quimby 1995).
>
> Unfortunately, the fates of the eastern (Tsuga canadensis) and Carolina (T. caroliniana) species of hemlock in North America are uncertain. The hemlock wooly adelgid (HWA, Adelges tsugae), an aphid-like insect that was accidentally imported to North America from Japan in the 1950s, has been decimating hemlock trees and altering the forest ecosystem. Because the adelgid did not encounter any serious natural enemies on this continent, it has flourished here. It is now found in all states from Virginia to Massachusetts and is about to invade northern New England. After years of careful research the most feasible method of HWA control in sylvan setting has been importing a specific predator of A. tsugae, known as the Japanese predacious ladybird beetle (Pseudoscymnus tsugae). Obviously, introducing one nonnative species to combat another involves a great deal of risk, but so far (six years after the first release) Pseudocymnus tsugae seems to be gaining control over the adelgid population without causing visible ecological damage (McClure 2001). Nevertheless, most of the research and some potential surprises may still lie ahead.

Perhaps this second beginning feels satisfying to me as the literate lay reader because Ewa realized that rather than producing a "narrative of science," she should produce what Greg Myers terms "a narrative of nature," which succeeds by "foregrounding the activity of the object and obscuring the activity of the scientist" (1990, 189). In a narrative of nature, Myers argues, "the plant or animal, not the scientific activity, is the subject, the narrative is chronological, and the syntax and vocabulary emphasize the externality of nature to scientific practices" (142). To produce a mini-review Ewa had to turn to a symbiosis she knew well. She had to claim her expertise and authority. She had to assert motive. She had to acknowledge that as the writer of a second mini-review she found herself once again in a recurring social situation, a situation in which she was striving to satisfy nonspecialist readers as well as David, and so she not only changed her writing, she changed her process of writing. She sought out readers' responses to her draft. Maybe it is good experience for students writing in biology—or in any discipline—to be asked to write in the various genres of the discipline. For Ewa it was.

It was only after the convocation reception that I realized just how cool the work David and I had done together was. A year later, the experience still affected David as he wrote his own review article. A year later, I found myself wanting to think and write about symbiotic relationships and mini-reviews and my work with a mycologist. In working together to plan workshops for students writing about symbiotic relationships, we had formed our own symbiotic relationship. How often, really, do mycologists and compositionists collaborate?

I may have known little about the science of mini-reviews, but because of what I know about the teaching of writing, I was able to name, and help David name, the writerly moves mini-review writers must make. David had experience writing in a variety of scientific genres, and while the students and I had to determine how mini-reviews were different from other genres we had written and read, we also had to help David understand that he knew the differences tacitly, but needed to teach them consciously and actively.

It was, however, the awareness of audience that I believe was most important in facilitating all of our learning. Each of us—David, the student writers, and I—had to consider what a mini-review is, why mini-reviews exist, and why we would want to read them. What was cool about the workshops was that they created a space where David and I, symbiotic

translators, could help the students explore a new genre. Though written for David's class, the mini-review required the students to own disciplinary knowledge and speak to others as working scientists. By working to articulate what was cool about pines and nutcrackers, or sea slugs and chloroplasts, students learned to stake a claim for themselves as scientists writing to other learned readers. The workshops remind me, even today, that the relationship between writer and reader, between one genre and another, or even one field and another, is itself a symbiosis.

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