J Canc Educ
DOI 10.1007/s13187-011-0202-6

REFLECTIONS

Teaching Effective Writing Skills at an Academic Cancer Center: Reflections of an Erstwhile Journal Editor and Writer

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In the July 2010 edition of JCE, Cameron et al. described a program that addresses the linguistic barriers of international research trainees at MD Anderson Cancer Center, suggesting that "linguistic barriers in science affect not only affect researchers' career paths but institutional productivity and efficiency as well." Nobody would dispute the value of teaching effective writing and communication skills to foreign investigators; however, I daresay that many US-born and -educated investigators also need to learn to write and communicate more effectively. In my career working with PhD and MD students, postdoctoral fellows and clinical researchers, and faculty at all levels at several medical schools, it continually amazes me how many investigators struggle with basic writing, many aspects of which can easily be taught. I have frequently pondered why scientists write poorly. One reason is that scientists often equate long, complex sentences and paragraphs with deep thinking. But the simple fact is that "academic" puffery—stilted, complex, and confused writing—is misunderstood by the reader and does not serve the author.

For example, consider this sentence from an abstract, sent to me by a researcher (their *final* version):

> "A key element in the understanding of the pathogenesis of glial tumorgenesis is first identifying the cell of origin and how they may be impacted by cancer cellular microenvironments during the process of oncogenic cellular transformation that alter immune control…"

This sort of writing from a confused author confuses also the reader, who tries to guess the meaning. When I asked the author to clarify this sentence, he responded with some embarrassment and, in remarkably clear and direct language, he said, "well to better understand the pathogenesis of glial tumors, we first have to establish cancer 'stem' cell subpopulation within the tumor mass capable of resisting therapies and initiating secondary tumors following treatment. And, brain tumors show remarkable cellular complexity, allowing them to differentiate into vessels and neurons and glial cells. We are wanting to reveal in particular how brain tumor cells shape their microenvironment and thereby escaping immune control."

Diplomatically, I explained that his message was not communicated clearly (I *was* being nice) and we sat down and rewrote the abstract together, adding a number of details to clarify his message. Unfortunately, many like-minded scientists end up with rejections from a journal or a funding agency because of such confused and disorganized writing, which ends up delaying the dissemination of important scientific findings to their colleagues.

This problem is altogether simply avoidable.

Communication skills are not traditionally included in the curricula of medical schools or graduate programs nor at medical centers. But they should be a fundamental and required part of any career training program.

I have spent my own career helping investigators write more clearly. In my years at Stanford Medical Center and at the Cancer Center at Dartmouth amongst other institutions, I have worked with investigators at all levels of training. The most common problems for investigators writing National Institutes of Health (NIH) grants are poor organization; unclear writing; flawed logic; not adequately responding to NIH review criteria; and poor grammar,

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Published online: 19 February 2011

punctuation, and syntax. In working with investigators at many academic institutions, I have found that basic instruction in grant organization, outlining, and clear writing were keys in helping investigators write successful grants. As a former journal editor, I have found also that many young investigators had few skills to construct a competitive manuscript. One of my largest concerns has been that many more established mentors either did not believe that writing skills could be taught (and that the investigator either sinks or swims on their own) or had flawed beliefs of how to write a paper—often passed onto their mentees. Whatever the sources of misinformation, it is clear that many potentially important and novel papers are rejected because of writing flaws, and potential and good research never makes it to the manuscript stage—often because investigators found it too daunting to construct a manuscript.

At Dartmouth, we offer courses in NIH grant writing, manuscript writing, presentation skills, and basic scientific English. Our classes are in large demand and I have been told by countless researchers that useful writing strategies and one-on-one sessions to discuss a grant application have helped them write more clearly and effectively.

Here, I offer some advice from my experience in working with students and investigators at all levels at many different institutions. It is advice that most respected journal editors and good writers will give you. At the risk of oversimplifying this—here several cardinal rules of writing that I hope you will take to heart.

1. *Know your reader*. Most writers write for themselves, ignoring their overarching goal: writing for the reader. Without considering who will read your article, you will not first consider how fully you should explain more difficult concepts, what figures or tables to include, what terms and concepts you need to define. In some highly specialized journals, this may seem obvious. However, with readership world-wide and science becoming increasingly cross-disciplinary, writers must consider a more common audience than might seem obvious. Before you start typing from that blinking cursor, consider your audience—many journals publish this information in their instructions online. Talk to an experienced peer reviewer of the journal, if possible, to better understand the readership. It will serve you well.
2. *Outline your work*. You remember how to do this from your freshman English class. Without an outline, you will walk through a minefield of disorganized and wayward thoughts. Starting to write a paper with that unforgiving blinking cursor is nothing short of trying to build a house without a design blueprint. The end product ends up a mess of disorganized and illogical thoughts, many redundancies, and irrelevant material—all of which makes the work much harder for the writer, sometimes impossible. One of my wise mentors at Stanford, an outstanding writer, told me "the best way to edit a disorganized paragraph is to just swipe through it and hit DELETE." Many of the papers and grants I receive for review often require substantial rewriting to untangle a mess of long, illogical paragraphs, redundancies, and confused concepts. Unfortunately, once the ideas are put down for consideration, untangling them and reorganizing the paper takes far longer, is tortuous, and often results in an inferior product than if they had written it from an outline—just like the poorly designed house with disorganized spaces, layout, wiring, plumbing. Some of the paragraphs just have to be torn apart and reordered, compounding the writer's problems, creating a patchworked nightmare, and costing the writer valuable time. A prominent journal editor once told me "in my experience, no experienced researcher writes a grant or paper without a good outline." Follow this recommendation!
3. *Never write the research paper in the same order it is presented*. Starting with your abstract and moving to introduction, methods, etc., is a mistake and will create more work for you. In the process of writing a paper, especially in making the outline, authors discover new ideas and may take different directions. Thus, my advice, and that of many journal editors I have worked with, is to start with your figures and tables. Consider your data, talk to your colleagues, think about what the data is telling you, and then create your results. I often print my figures and tables and spread them out in front of me—what are they telling you? In your outline, you start framing your findings carefully. I say *carefully* because so many writers take the lazy route and end up regurgitating what is obvious from a figure or table, wasting valuable space but more importantly, insulting the reader's intelligence. If you have carefully crafted your figures and tables—and this means going through many revisions—your reader will be able to immediately understand them. Point out for them what is *not* obvious. Look through some top-level journals in your field—or better yet, outside of your field and see how they do it. You will see some pretty sophisticated figures and tables that stand on their own and are clear at first read—they have gone through countless edits by the authors and journal editors alike.

   Once you frame your findings using your figures and tables, and from your outline, frame your discussion and introduction next. The methods section often can be put together anytime, but it usually will need

refining once you finish your results. The discussion is critical to a paper, and so many investigators make the mistake of going off on sidetracks not relevant to their central hypothesis and findings, and many times, authors will make conclusions not clearly supported by their findings. This is a deal-breaker for journal editors, and can often be a central reason for the paper's rejection. Discussions should put your findings in the context of other research findings, discuss weaknesses, and especially tell the reader *what's next*? Research is not carried out in a vacuum—your findings always suggest future studies, and it is important to tell your reader what you plan to do next now that you have gotten these results. Also, the introduction often suffers, largely because writers have not outlined their thoughts first, and they end up writing an exhaustive and disorganized background, some of which is not relevant to the problem. You introduction should be short and strong—a precise background and significance that follows a logical framework. What is the problem? What do we know about it? What are our gaps in knowledge? What is my hypothesis? And how am I going to fill that knowledge gap to help solve the stated problem? And, most importantly, why is this important? Take a clue from the NIH—the new grant structure now must include a separate section, *Significance* in which you must detail why this problem is important to human health and disease. You then end the introduction with a clear and short statement of objective like "Here, our objective was to…".

Abstracts are written last. Also, do not fret over your title. Start with a working title if necessary, but you will refine it once you finish so it can be more sculpted to your paper's subtle purpose.

4. *Revision is at the heart of good writing*. Put the paper draft away for a couple of days. When you re-read it, I guarantee you will find basic errors, many redundancies (which should have been minimized by your outline), and confusing sections. Think of your reader when you are revising—who are my readers and what do they need to know? Also, give your paper to a colleague—it is a necessary part of revision. A different point of view, whether you agree with it or not, always refreshes your perspective. You may think of yourself as an "independent" investigator, but that does not mean you work in a vacuum. Do not exclude your colleagues' ideas! And, in revising your work, learn to cut ruthlessly. Most papers I edit are 20–30% too long, with many redundancies and convoluted sentences that the author did not see—the track changes help them to see, but learn to carefully edit your own work. Sometimes, swiping through a tangled paragraph and hitting the DELETE button is necessary!
5. *Take some lessons from professional writers*. Scientists often ask me how I write. I find the time—usually I schedule the time—then pick a quiet place to write, free from distractions, close my door, and decide on a goal. *Today, I will write my results and discussion from my outline* might be a good goal. But under no circumstances will I open my paper when I have only a few minutes and try to do any serious work. Good writing requires dedication and concentration, and TIME. Unfortunately, many scientists try to write a paper in one sitting, go through one or two cursory edits on their own, and send it into the journal, all within a few *days*. Most good papers require *weeks* to write and will undergo many revisions—sometimes five or six drafts and other authors' input and consideration. But remember, if you are the paper's first author, it is your solemn responsibility to take all authors' input, consider them for inclusion or not, and assure that the paper holds together with all the additions and deletions that are part of revising. I have seen some big papers turn into a nightmare of confused paragraphs and differing styles that sometimes are unrecoverable and they had to be rewritten from scratch. Do not go there.
6. *Speak when faced with problematic passages and confused writing, read it out loud to yourself or a colleague*. Linguistic research confirms that seeing *and* hearing what you have written will help clarify the difficulties and confusion. And, when speaking your thoughts before they are put on paper, especially because the writer is not trying to wordsmith the writing to impress their reader, the thoughts often flow more naturally and easily. For example:

   In an elevator, a colleague asks William, a young medical educator, about his recent study on medical curriculum. "What did you find in your study, Bill?"

   "Basically, we found that medical teachers of undergraduates tend not to let students look after the more difficult patients."

   Later that evening, William sits down at his computer and wrote:

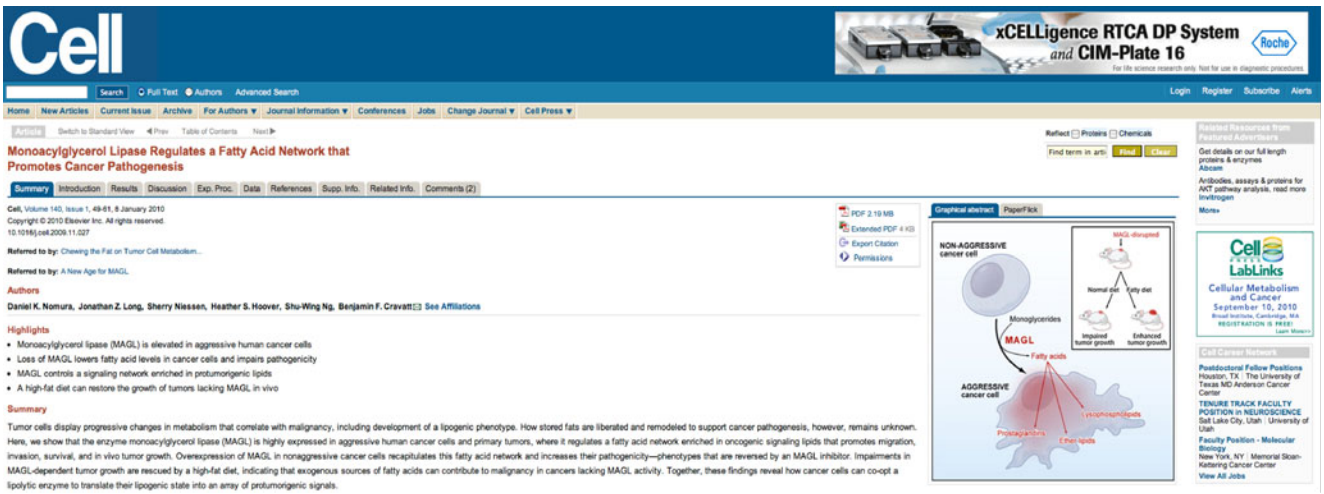
> "The present analysis confirmed the hypothesis that clinical instructors of undergraduate medical students would rather choose education instructional techniques limiting active student involvement in patient–care activities when faced with problematical clinical situations."

   It probably took Bill a long time to write that important-sounding sentence and I am sure he felt particularly gratified at its complexity and seemingly deep thinking. But it simply confused the reader, the journal editor, who became increasingly annoyed with Bill's writing style. It was re-written, much like Bill's original explanation to his colleague.

Often, scientists can more easily express their thoughts through speaking. Writing down those verbalized thoughts usually makes it easier to navigate through the many complex ideas and thoughts, especially when they have already been outlined. So, the next time you are navigating through your cumbersome prose, stop and read it aloud. You will more clearly see the problems.

7. *Learn to be visually literate*. From the beginning of time, humans have communicated visually and have learned to interpret, negotiate, and make meaning from complex information presented in the form of an image. Visual literacy is based on the idea that pictures can be "read" and that meaning can be communicated through a process of reading. I believe that in communicating science, particularly in an increasingly complex word of subspecialized ideas and language, becoming more visually creative will serve you well.

One of the first telling aspects of a manuscript or a grant to a reviewer is its figures and tables. But many investigators think only of the obvious ways to display complex information. There are many creative ways to simplify or convey complex mechanisms of action, study designs, and other concepts visually. [Image retrieved from www.cell.com (Accessed 2 Nov 2010).]



This has been recognized by some journals as paramount. The highly respected journal *Cell* has launched a new format for their online presentation of all research articles. This "Article of the Future" offers a visual display of the authors' complex ideas in a visual abstract that help readers easily grasp the points of the paper. I believe it is the future of publishing.

Such visual literacy, I believe, also helps writers think through complex ideas. Drawing it in some sort of graphical format will help to clarify your thought. And clear thinking is a prerequisite for clear writing. Without it, a writer remains tangled in their own muddled thoughts.

Where does this leave us? Writing is a personal activity, much like drawing or playing a musical instrument—the writer and artist learn much the same way: trying different approaches, making mistakes, and ultimately through practice, becoming more proficient. The scientist who wishes to communicate through the written word must also practice frequently, but they must have help, much like from a music teacher, to point out their mistakes and help them improve. Unfortunately, not all scientists have a mentor to help them.

It is my hope that this advice helps you to improve and encourage you to write more. But find a trusted colleague anyway and work together to read each others' work, form a journal writing club, anything to get feedback on your writing.

And do not get me wrong, writing is hard work for the novice and experienced writer alike. With a lot of practice, you will eventually get to that confident place, a place in which your writing really sings with simple and lucid sentences and paragraphs, and really tells your reader everything that you meant to say.