"Your Thoughts Are Like a String of Pearls"

Reflections of an Erstwhile Journal Editor and Writer

CHRISTOPHER DANT, PHD

"Your thoughts are like a string of pearls!" This was the reaction to the first draft of my research paper provided by a Senior Editor of JAMA for whom I apprenticed some 30 years ago on my first job out of academia.

I smiled and enthusiastically thanked him—after all, I worked *hard* on that paper.

"You misunderstand! By that, I meant that your thoughts are like a string of loose unconnected sentences, much the same in form throughout, and, well, otherwise boring, confused, and difficult to understand."

The words cut into me, the young scientist-apprentice. After all, I was a *trained* scientist, and had written several journal articles and grants in academia. Surely, I had learned *something* about writing from this experience. I struggled for some comprehension—was it possible I *didn't* know how to write? Perhaps my editor could be wrong and another opinion would be more favorable. But he wasn't wrong and another opinion would have just confirmed the diagnosis—bad writing!

The physician-editor sat me down and meticulously went through his marks—there was a sea of red on every page (yes, this was before computers!). Through the painful lessons, I had obviously forgotten some basic principles from my freshman writing classes. "Omit needless words! Vigorous writing is concise. A sentence should contain no unnecessary words, a paragraph no unnecessary sentences, for the same reason that a drawing should have no unnecessary lines and a machine no unnecessary parts!" This was the advice essayist and editor E.B. White took from his Cornell English professor William Strunk. "The Elements of Style," from which this was taken, was one of the first books I had read in writing class. I had forgotten its advice. "Clarity, clarity," was the constant exclamation from my freshman English professor. My thinking and subsequent prose had become muddled, riddled with redundancies, and confused.

"No good editor will accept this paper!" he warned, looking at me sternly over the top of his reading glasses. "But with enough work, you'll learn how to write well the first time...now, go back and start over with an outline!" I walked away with my proverbial tail between my legs. I thought, *an outline, start over...why should I do that*? Underneath, however, I felt somehow hopeful that he was willing to help me. I was bound not to repeat the failure. But I did. Many times. *This could be a big problem for my career*, I thought. *Why can't I express my thoughts clearly*?

Eventually and slowly, I learned how to write clearly through much laborious practice and making mistakes repeatedly—especially, I learned by how easily my readers could grasp what I had meant to communicate. But it was hard work. I tried reading books on writing; there were so many of them, but I quickly learned that they were mostly not helpful and you can't learn to write by following the advice in a manual, no matter what the advice.

In the many intervening years working with young (and experienced) students and faculty, I learned that many investigators never had a mentor that helped them with their writing—or, the advice given them was simply misleading and not helpful. In fact, I have been told by some investigators and students that their mentors believe that writing can't be taught, and you either sink or swim on your own. This large misconception stems from an ignorance about writing that has been pervasive in academia since I can remember.

Over the years that I have taught courses about scientific writing, it continues to amaze me how many scientists struggle with basic writing, many aspects of which can easily be taught. I have frequently pondered why scientists write poorly. One universal tenant of writing 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 doesn't serve the author. For example, consider this sentence, part of an abstract, sent to me by a prominent scientist (their *final* version):

> *"The influence of age (younger vs older) has been reported recently*

Image retrieved from halcyonhealth.ca (Accessed 31 Oct 2010).

"To be a good writer, you have to be a good reader...of good writing."

for multiple sclerosis disease in the context of a more rapid clinical response."

This sort of writing from a confused author confused also the reader, who tried to guess what she really meant. When I asked the author to clarify this sentence, she said, "Well, I think it was clear! We found that our younger multiple sclerosis patients—those under 55 years—had a more rapid clinical response compared to the older patients (over 55 years of age). That's what it says!" Her stubbornness and emphatic stance confirmed for me what I already knew: many authors are insecure about their writing because it is a personal activity, and they copy the academic language that they see in many journals and other scientific forums—much of which is confusing and difficult to understand. Layer on that confused thinking in the first place. Unfortunately, this author ignored my advice and the abstract was rejected by the editors of the scientific congress. She realized her tenable position and we rewrote the abstract together and it was eventually published. And she learned something about writing, a much more valuable lesson. Unfortunately, many like-minded scientists end up with rejections from a journal or a funding agency because of confused and disorganized writing, which delays the dissemination of important scientific findings to their colleagues.

This problem is altogether simply avoidable.

Thus, to all you budding scientists and young investigators out there who wish to learn how to write well, I offer some of my advice from experience of working with students and investigators at all levels at many different institutions. It's advice that most respected journal editors and good writers will also give you. At the risk of oversimplifying this—here are several cardinal rules of writing that I hope you will take to heart.

1. To Be a Good Writer, You First Have To Be a Good Reader

Especially of good writing. Unfortunately, much of the literature is poorly written. "There is no form of prose more difficult to understand and more tedious to read than the average scientific paper" wrote Francis Crick in 1994. The co-discoverer of the structure of DNA was acknowledging what everyone in science knows: research papers can be a nightmare to read.

What should you read? I suggest something basic, not directly in your field of expertise because you'll separate your critical scientific thinking when you read the paper. Papers in *Nature, Science, Cell, Science, The New England Journal of Medicine* are known sources of good writing among many others. And there's a host of specialty journals—most fields have journals that are considered top in their field, some not so. Frankly, reading good literature in general is essential to re-training your brain to good English construction and style–*The Great Gatsby* is, in my opinion, a gold standard of outstanding writing. So, read well-written material often–at least once or twice a week.

2. 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 very specialized journals, this may seem obvious. However, with readership worldwide and science becoming increasingly cross-disciplinary, writers must consider a wider audience than might seem obvious. Before you start typing from that blinking cursor on your screen, 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 your readership. It will serve you well.

3. Outline Your Work

You remember how to do this from your freshman English class. Without an outline, you'll walk through a minefield of disorganized and wayward thoughts. Starting to write a paper with that blinking cursor is nothing short of trying to build a house without a blueprint of design and foundation. The end product ends up a mess of disorganized and illogical thoughts, redundancies, and irrelevant material—all of which makes the work much harder for the writer, sometimes impossible. One of my 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 the author had outlined the work—just like a 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 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!

4. Never Write the Research Paper in the Same Order It's Presented

Starting with your abstract and moving to introduction, methods, etc, is a waste of time and will create more work for you. In writing a paper, especially in making the outline, authors discover new ideas and may take different directions. Abstracts are written last. Also, don't fret over your title. Start with a working title if necessary, but you'll refine it once you finish so it can be more sculpted to your paper's purpose. 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 me? 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's obvious from the figure or table, wasting valuable space but more im-

portantly, 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's *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'll see some pretty sophisticated figures and tables that stand on their own and are clear at first read–they've 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 results. 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's important to tell your reader what you plan to do now that you've gotten these results. Also, the introduction often suffers, largely because writers have not outlined their thoughts, and they end up writing an exhaustive background, some of which is not relevant to the problem. Your introduction should be short and strong—a precise background and significance that follows a logical framework: what is the problem, what do we know, and what are the gaps in our knowledge, what is my hypothesis, and how am I going to fill that gap to help solve the 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 ….".

5. 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 have been minimized by your outline), and confusing sections. Think of your reader when you're revising—who are my readers and what do they need to know? Also, give your paper to a colleague—it's a necessary part of revising. A different point of view, whether you agree with it or not, always refreshes your perspective. You think of yourself as an "independent" investigator, but that does not mean you should by working in a vacuum. Do not exclude your colleagues' ideas! And in revising your work, learn to cut ruthlessly. Most papers I edit are 20% to 30% too long, with so 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 key is necessary!

6. 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 on it. 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 perhaps a few days. Most good papers require *weeks* to write and will undergo many revisions–sometimes 15 drafts and other authors' input and consideration. But remember, if you're the paper's first author, it is your solemn responsibility to take all your other authors' input, consider them for inclusion or not, and assure that the paper holds together with all the additions and deletions I have seen some big papers turn into a nightmare of confused paragraphs and differing styles that sometimes is unrecoverable and the paper has to be rewritten largely from scratch. Don't go there.

7. 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've written will help clarify the difficulties. And, when speaking the 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.

In an elevator, a colleague asks William, a young scientist, 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 difficult patients."

Later that evening, William sits down at his computer and writes: *"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 sentence and I'm sure he felt particularly gratified at its complexity and seemingly deep thinking. But it just confused the reader, who became increasingly annoyed with Bill's convoluted writing.

Often, scientists can more easily express their thoughts through speaking. Writing those verbalized thoughts down 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'll more clearly see the problems.

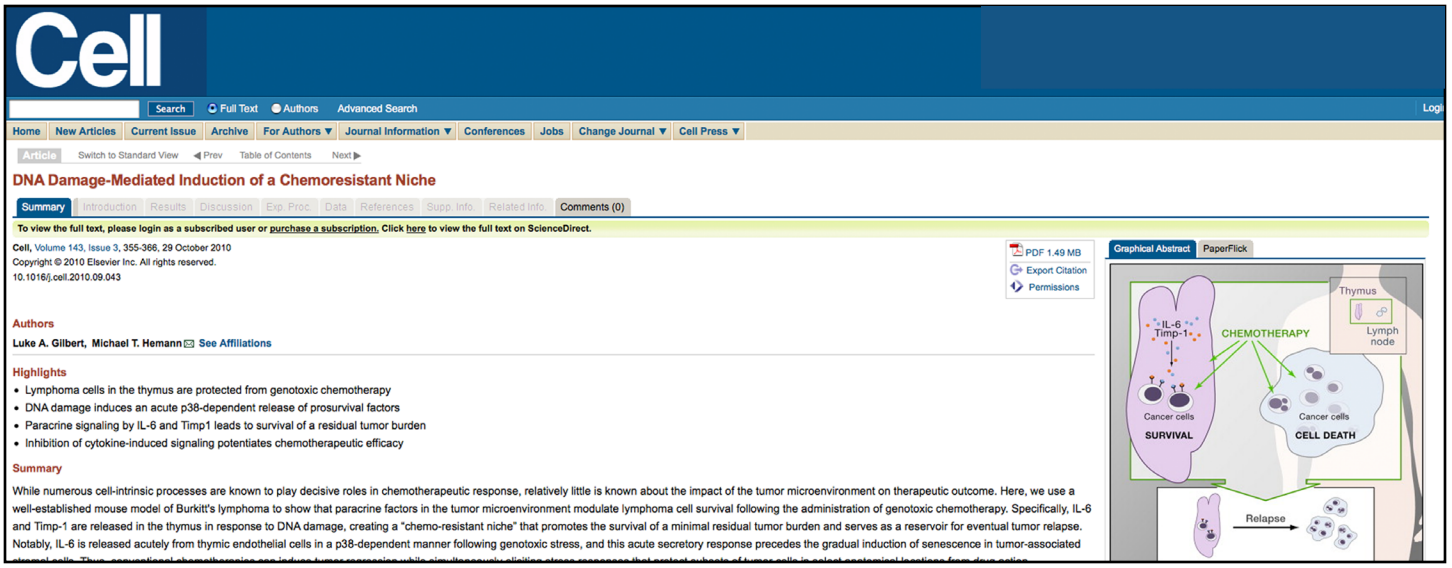

Image retrieved from www.cell.com (Accessed 2 Nov 2010)

The journal *Cell* has launched a new format for their online presentation of research articles.

8. Learn the Elementary Rules of Punctuation and Use Them to Your Advantage

Skillful punctuation is the backbone of good writing. As a classic example, if you read "Woman without her man is nothing," you'd wonder if it should be punctuated as "Woman, without her man, is nothing." Or, "Woman: without her, man is nothing."

Skillful use of semicolons, comas, parentheses, dashes, and periods can clarify a confused sentence or string of tangled thoughts, assuming the message is all there. In general, I would say that most often, scientists need to insert more periods and make their sentences shorter and more direct. For a good summary of punctuation, see the "Elements of Style" at www.bartleby.com/141/strink.html

9. 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 are 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.

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

Especially in grants, visually representing the study's progress in a simple chart of milestones and timeline or explain complex organization of the work with multiple laboratories and investigators impresses reviewers.

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 clarity of thought is what clear writing is all about. Without it, a writer remains tangled in his own muddled thoughts.

Where does this leave us? Writing is a very personal activity, much like drawing or playing a musical instrument—the writer and artist learns much the same way: trying different approaches, making mistakes, and ultimately through practice, becoming more and 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, the budding scientist, to improve or gives you some push to do 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 don't get me wrong, writing is hard work for the novice and experienced writer alike. With a lot of practice, you'll eventually get to that more confident place, a place in which your writing really sings with simple and lucid sentences and paragraphs, and tells your reader everything that you meant to say.

Guest columnist Christopher Dant is a faculty member at the Dartmouth Medical School and Norris Cotton Cancer Center. He teaches students, postdoctoral fellows, and faculty how to write, and works with faculty on their grants and papers.