By **Jeffrey J. McDonnell**

Paper writing gone Hollywood

"So you want to be a writer?" one of my professors asked me when he learned I was interested in a career as an academic scientist—a pointed warning that a life of science is also a life of writing. But even knowing this in advance, I found that writing was a challenge as I made my way down the tenure track. I had trouble finding stories in my data sets. Even when I had a good tale, I struggled to tell it. I tried starting with the opening sentences and hoping I'd make it to the paper's end. But more often than not, I wrote my way down many blind alleys. My permanently unfinished papers outnumbered my published ones. Worst of all, I was not helping my Ph.D. students and postdocs learn proper writing craft.

My big break came shortly after getting tenure. In a passing conversation, a senior colleague mentioned that his process for writing research papers centered on structure. Rather than focus on words and sentences, the part of writing that so bogged me down, he highlighted the importance of outlining the overall story to be told. I had thought that the standard paper structure—introduction, methods, results, discussion, conclusions—was enough to keep me on track. But my colleague helped me realize that, even with those sections, there is still enough freedom to get stuck in writing cul-de-sacs.

"I … ask the Ph.D. student or postdoc to play the role of would-be movie director."

I now see each of the standard paper sections as its own Russian nesting doll. Writing papers is easiest when you spend considerable thought and time stacking all these pieces first. I call it the top-down writing approach.

Each of my group's papers now starts with a storyboard session at a whiteboard. I pretend to be a big-time Hollywood producer and ask the Ph.D. student or postdoc to play the role of would-be movie director pitching a new movie to me. Their pitch must answer three questions: What is the status quo? What is wrong with the status quo? How does this new paper go beyond the status quo?

This approach helps frame the story and place key figures and technical findings in context. Balancing each of the status quo elements is a great way to set up the introduction—often the toughest section for early-career scientists to write—and to lead the reader to the research questions or hypotheses. Say too little about what we already know and one risks losing a large audience who may be unfamiliar with the topic. Too little about what's wrong with the current state of knowledge and the reader may wonder why we need yet another paper on that topic. Too little about how the work goes beyond what others have done and the novelty is unclear. The result is a roadmap of the novel elements in the work, which brings the discussion—the other tough section for the writing newcomer—into final focus.

Once the pitch makes sense, we go back and forth stacking the Russian dolls on the whiteboard until the outline subheadings become paragraph topics, with every paragraph explicitly represented in the outline. Honing this outline prior to any writing allows us to determine whether the research story resonates from start to finish. We might spend days or weeks on the outline to get it right, but it's time well spent. The slavish adherence to nested headings shows at a glance whether the paper makes a clear and worthy contribution; whether the title, objectives, and results are properly aligned; what figures are truly essential to the storyline; and whether the message hums. Writing then becomes a much easier process of filling in the blanks. The paper is effectively finished before the sentence writing starts.

I haven't mastered the writing game, and I am still constantly learning. But the top-down approach has been a game changer in my group. Now, when a new grad student indicates an interest in an academic career, I ask, "So you want to be a Hollywood producer?" ■

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