

## Tips from www.sciwriting.cn

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**Writing a scientific paper is a struggle for students all over the globe. Chemists and engineers in the US (C&EN, August 13, 2007) provide the following suggestions (in no particular order) for writing excellent manuscripts:**

### Tip 1. Conduct thorough literature searches and cite precedents.

"Good literature searching allows you to provide a cogent paper that is well-thought-out and well-organized, and it also keeps you from embarrassing yourself," says analytical chemist W. Jeffrey Hurst at the Hershey Co. For example, it behooves you to discover earlier work rather than later "that what you thought was seminal work has been reported on 12 times" already, he says.

### Tip 2. Read scientific literature for content and style.

Study lots of articles for technical material, but keep an eye out for particularly clear writing styles and incorporate them into your work, says catalysis chemist Gregory C. Fu at Massachusetts Institute of Technology. Crystallographer Anthony L. Spek at Utrecht University, in the Netherlands, also suggests reading well-written papers in the specific journals you want to publish in.

### Tip 3. Clarify authorship carefully.

Sometimes the authorship is straightforward; sometimes it's not. Authorship on journal articles can become an ethical issue, and in certain cases, disputes have cost scientists their jobs and reputations. "Be meticulous and make sure that authorship is correct," recommends Sean B. Seymore, a professor of patent law at Northwestern University who holds a doctorate in chemistry and has written about authorship abuse (<http://law.richmond.edu/jolt/v12i3/article11.pdf>).

### Tip 4. Get organized now.

Most authors develop a plan for organizing a paper sometime near the end of completing the lab work. Some researchers pull out the original research grant proposal, scribble the main points on a whiteboard, or take a stab at an abstract.

Other authors use writing as a tool to guide their research. Chemist George M. Whitesides at Harvard University advocates early outlining so strongly that he wrote a paper about it (*Adv. Mater.* **2004**, *16*, 1375).

A former Whitesides postdoc, Teri W. Odom, adopted the process for her materials research group at Northwestern University. "The principle of the Whitesides' paper-writing process—

that outlines and drafts should be constructed in the course of solving a problem rather than after all the data have been analyzed—has been useful."

She says her group will often go through about eight outlines before drafting the manuscript. As an exercise, Odom also requires students to complete a fully referenced paragraph written in the *Nature* format ([www.nature.com/nature/authors/gta/Letter\\_bold\\_para.doc](http://www.nature.com/nature/authors/gta/Letter_bold_para.doc)).

### Tip 5. Take your time - allow months for revision.

Cornell University chemistry professor Roald Hoffmann, a Nobel Laureate, goes through many drafts of a manuscript with his students. "A typical number is 23," he says.

### Tip 6. Know your audience.

Non-specialists will read your journal article. **Hoffmann advises scientists to "write the manuscript for an intelligent graduate student, not a professor."**

When writing up interdisciplinary work, take nothing for granted and explain everything, says University of Iowa physical chemist Vicki H. Grassian, who works on environment-related surface science and nanotechnology. For example, she has had reviewers repeatedly question particular calculations for atmospheric reactions that have been "routinely done in heterogeneous catalysis for more than 50 years," she says.

### Tip 7. Tell clear and concise stories.

Many researchers refer to journal articles as the "stories" of their research. No one likes a long-winded, disorganized, tangential, and confusing story. **Chemists and engineers suggest focusing on critical content and succinct sentences.** "Create no mysteries—those that nature provides are sufficient," Hoffmann says.

### Tip 8. Seek help with grammar and language.

"One often hears that English has become the de facto language of science," says Patrick H. Vaccaro, a physical chemist at Yale University. "As a reviewer for several journals, it often seems more appropriate to state that 'bad English' has become the lingua franca of modern science." Vaccaro and other professors direct both native and non-native English speakers with poor basic writing and grammar skills to university writing centers and language classes.

### Tip 9. Learn from the best.

Graduate and post-doctoral advisers are just two sources of writing advice. "Don't be afraid to ask other researchers who have been successful in achieving top-tier publications and funding or who are known as good writers to review your material," says chemical engineer Thomas H. Epps III at the University of Delaware.

### Tip 10. Find several readers.

Journal articles contain a few big concepts and many small details that an author could miss.

Gabriela C. Weaver, a chemical education researcher at Purdue University, pairs upper graduate students as "writing buddies." They read each other's work before she provides comments. Utrecht University's Speks sends his manuscripts to colleagues who are not coauthors so they can comment on them before he submits them to journals.

Because mistyping a number can cast doubt on the rest of the results, organic chemist Roman Dembinski at Oakland University in Rochester, Mich., has every member of his group proofread each manuscript—whether they are authors on it or not. Chemist Thomas Higgins of Chicago's Harold Washington College points out that "colleagues in the humanities make good proofreaders."

**Tip 11. Write often.**

Chemists say putting down just one paragraph of observations each day can help improve writing. "Get as much experience writing as you absolutely can," says Cynthia S. Dowd, who recently joined the chemistry faculty at George Washington University. "Some PIs don't 'allow' you to write, but take a stab at writing the experimental section, introduction, results, and discussion anyway."

**Tip 12. Try different genres.**

Writing for the layman about non-science topics can be a fun and helpful way to improve your writing. For example, Michelle Francl, a theoretical chemist at Bryn Mawr College, in Pennsylvania, has published essays on topics ranging from parenting to music. Hoffmann has published so many scientific and literary works, among them poems and plays, that he now describes himself as a "theoretical chemist and a writer."