Learning to write well is a long process that comes through teacher modeling, instruction, practice, and feedback. Luckily, the writing process can be used to improve science learning, too. Here are a few good writing suggestions that integrate science while helping students develop their informational writing skills.

**Science Journals**

There is perhaps no better place than a science journal for students to develop informational writing skills. Daily journal prompts are one way to encourage students to write expansively about developing knowledge (see Figure 1 for sample journal prompts).

In journals, students make records of what they are doing in investigations—they organize data by creating tables and write observations based on their investigations. They record, via drawing and writing, characteristics of what they are observing (i.e., what a pill bug looks like and how it reacts in different settings). In using the journal in this way, students learn that making records of actual observations is something scientists often do and is a useful kind of nonfiction writing.

Beyond recording observations, students can use journals to write inferences based on their observations. For example, if students observe that pill bugs prefer walking on dirt, they could infer that the dirt is more like their natural environment—thus making meaning of their observations. Students will find that inferences made from early observations may change as they make more observations. This tentativeness in inferences is an intrinsic part of the nature of science, but by making the recordings in their journal students can track their ideas over time and note any observations that lead to a change in inference.

**Observations vs. Inference Charts**

Another tool that supports science learning while developing informational writing skills is the observation vs. inference chart—we’ve used this chart successfully to introduce primary students to the distinction between observation and inference. On the chart, one column is labeled “Observations” and the second is labeled “Inferences.” During a class discussion following an exploration, the teacher records student observations under the “Observations” column and then asks stu-
For example, after students have had time to observe snails up close, the teacher would collectively record students’ observations (i.e., “the eyestalks move when I touch them”) on the chart, then ask students to infer the meaning behind the observation (i.e., because they are trying to move them out of my way—to keep them safe.” The teacher can record the response on the inferences side.

After a few examples, students will begin making good distinctions between observations and inferences, and they can be given similar smaller charts for individual or small groups of students to record their observations and inferences about other investigations on their own.

**Student-Authored Books**

To gain simultaneous insights into a content area, research, and literacy, students can research and write their very own book on a theme, such as “A Book about Scientists.” Individual students or small groups can research subtopics—“What do scientists do?” “How do I become a scientist?” “What do scientists do in their spare time?”—and write chapters for the books (Figure 2, page 40). The chapters usually begin as notes from research or interviews of scientists.

Once the chapters are compiled, students then create a table of contents and a reference list to demonstrate...
that nonfiction writing must be based on accurate information. Next, students can illustrate the chapters with their own drawings. Afterward the book can be published for their classroom enjoyment. Publishing a book is another good place to reinforce accuracy in writing in terms of spelling and conventions and the process of writing. Prior notes that students take can be written in draft form to be edited by the students later as they work on the computer to type their chapters.

We keep copies of our student-authored books in free reading-time tubs, so students can revisit their work, encouraging both recall of information about scientists and the importance of writing informational text.

**Custom ABC Books**

For younger primary grades, have students collectively create informational text in the form of an alphabetical or counting book. Students will not only be practicing writing and research content; they'll be learning how to gain information from nonfiction text and group it into categories.

Start out by reading examples, such as George Ella Lyon's *A B Cedar: An Alphabet of Trees*, George Shannon’s *Tomorrow’s Alphabet* (1996), or Kathy Darling’s *Amazon ABC* (1996), then assign a content area to students or have them pick their own content area. Students can then record information about what they experienced on their field trip.

**E-mails to Scientists**

Finally, students can pursue science learning by writing to real scientists. Most appropriate for older elementary students, having students e-mail a scientist provides an opportunity for students to compose their own questions about science content. Or, students could interview scientists about how they became scientists and the kinds of work they do. Students could use these e-mail conversations as a basis for a nonfiction report on that scientific specialty. They could even be required to ask the scientists how they use writing in their work!

Teachers can find contact information for scientist e-mail pals by contacting local universities and science labs. For instance, Indiana University houses a science outreach office in their college of arts and sciences with staff whose purpose is to make contacts between university science faculty and K–12 education. A similar office is located in Washington State at the Pacific Northwest National Laboratory's Office of Science Education, which not only provides scientists to visit classrooms and interact with students but also provides professional devel-
opment opportunities for teachers. Teachers can find similar opportunities for contacts with scientists in their own local areas.

Reports and Other Uses
Nonfiction writing can also be used to help students develop understandings of science as inquiry, as students record observations, inferences, and results of investigations, and write formal reports to share with peers. Students can also use writing to design their own investigations, leading to a further understanding of investigations as recommended by the National Science Education Standards (NRC 1996).

Writings Are Assessments
Incorporating various nonfiction writing activities such as those suggested above not only facilitates students thinking about science content, but it also results in material/work that can help teachers assess student understanding.

For example, observation vs. inference charts can be used to capture a picture of what the whole class understands about a given topic. If a student records an observation of an investigation exploring whether pillbugs prefer light or dark environments as “pillbugs love the dark,” the teacher will know that the student is confusing the observation with an inference. The teacher can then ask the student to describe how he or she knows that pillbugs “love the dark.” When the students states that it is because pillbugs tend to stay in the dark side of their environment the teacher can point out to the student that moving to the dark side is the observation and the inference is that they “love the dark.”

Similarly, individual journal writings can be used to assess what individual students understand about a science content area. In a unit exploring electrical circuits, students could be asked to respond to a journal prompt of “How do you think electricity works?” several times throughout the unit. Initially the student may respond with something like “electricity is lightening,” whereas later in the unit the student may respond with something like “electricity makes things work,” and finally the student may respond with something like “electricity works through a complete circle—a circuit.” Thus, the teacher can track the development of the student’s idea over time, from less informed to more informed views.

Whether supporting content learning, guiding teacher instruction, or furthering the development of students’ literacy or science process skills—or all of the above—nonfiction writing opportunities are an essential aspect of science learning from which teachers and students benefit in many ways.

Valarie L. Akerson (vakerson@indiana.edu) is associate professor of science education at Indiana University in Bloomington, Indiana. Terrell A. Young (terrell_young@wsu.edu) is professor of literacy education at Washington State University in Richland, Washington.

Resources
Sayre, A.P., and J. Sayre. 2003. One is a snail, ten is a crab. Cambridge: Candlewick Press.

Connecting to the Standards
This article relates to the following National Science Education Standards (NRC 1996):

Teaching Standards
Standard B:
Teachers of science guide and facilitate learning.