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WRITING FOR A GENERAL AUDIENCE: SCIENCE JOURNALISM

Explaining scientific advances to the general public is a worthwhile—even a noble—endeavor. If you have a substantial background in the subjects you are writing about you will have a real advantage over most journalists, who typically are trained in journalism rather than science. But the purpose of this chapter is not to prepare you for a career in newspaper or magazine publishing. Rather, I include this chapter because **writing for a general audience can sharpen both your thinking skills and your writing skills:** writing, thinking, and speaking are all interconnected.

Assimilating a piece of research published in the primary scientific literature and reorganizing that information to produce a successful piece of science journalism is an excellent exercise in summarizing information, simplifying complex material, and de-jargonizing your writing. Most important, **writing for a general audience of intelligent nonscientists is a wonderful way to tell if you really understand something**, and to show your instructor how much you have learned from what you have read. The science journalist is essentially a teacher. But as you may have discovered already, trying to teach something to someone else is one of the best ways of teaching it to yourself. It can also be fun—fun for you to write and fun for your instructor to read.

SCIENCE JOURNALISM BASED ON PUBLISHED RESEARCH

Science journalism differs from most of the other forms of writing discussed in this book in that **the take-home message is always presented at the beginning of the article** rather than at its end. That is, the article *begins* by summarizing what follows. By the end of the first or second short paragraph, for example, one typically finds sentences like these:

> Scientists have now found that lobsters use an internal magnetic compass to navigate during their annual mass migrations into deeper waters.
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> In a recent report published in the journal *Nature*, Professors Tia-Lynn Ashman and Daniel J. Schoen present the remarkable finding that plants time their production of flowers in much the same way that people run efficient businesses.
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> According to Professors Graziano Fiorito and Pietro Scotto, working at their laboratories in Italy, the common octopus can not only be trained to distinguish between objects of different colors, but can in fact learn to make these distinctions more quickly from each other than from human trainers.
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> Researchers at the Dr. Seus School of Medicine and the Mt. Auburn Hospital have discovered an inherited molecular defect that makes some people naturally resistant to malaria, a disease affecting over 300 million people in tropical areas around the world.

Often such sentences begin the article. In other cases, summary sentences are preceded by one or a few sentences designed to stimulate additional reader interest in the topic. The opening sentences are known as the "lead." **Leads tend to follow one of 4 major formats: the simple statement, the bullet lead, the narrative lead, and the surprise or paradox lead.** Some of these leads allow the writer considerable room for creativity.

The Simple Statement and Bullet Leads

The first lead is a simple but dramatic statement of the major finding, usually in a single sentence, as in the example about malaria given above. A more interesting lead, but one that is more challenging to write, is called the *bullet lead*. Actually, it consists of 3 bullets, which are always followed by the general summary statement. For example:

> We all know people who have trained their dogs to fetch the daily newspaper without tearing it. Similarly, we all know that horses can be trained to respond to the slightest movement of their riders. And we all know that goldfish can be trained to come to the front of the fish bowl at the sound of a bell. Now it turns out that even octopi (*Octopus vulgarus*) can be trained to perform certain simple tasks, and that they actually learn those tasks more quickly from each other than from a human trainer.

If the bullets are fired successfully, by the end of the third "shot," the reader is wondering how the individual bullets are related and where they are "leading." And just at that moment, the skillful writer answers those questions; if done properly, the reader wants to read more.

The Narrative Lead

The narrative lead tells a story of some sort, and then follows up with the summary sentence:

> Sitting at the bottom of a large glass tank is a 2-pound octopus. The octopus has been trained for several weeks to avoid balls of one color and to pick up balls of a different color. Every day for 6 hours he has been rewarded with food for choosing the right balls, and punished with mild electric shocks for choosing the wrong ones. Now, he sits idly in the tank, his eyes apparently following every movement of the researchers as they prepare to set up the next experiment, his mantle cavity filling and emptying in a consistent respiratory rhythm.
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> The researchers bring over a tank containing another octopus, one that was freshly collected that morning from the warm and inviting waters just outside the marine laboratory. The 2 octopi quickly crawl toward each other in their respective tanks, peering through the glass with apparent interest. ''Now watch this,'' one of the researchers says to the newcomer, as she puts the trained octopus through his morning paces. The newly collected octopus watches, and seems genuinely interested in what the other octopus is doing. Now the researchers offer the same choices to the new octopus. Remarkably, after watching only

4 trials, the observing octopus chooses the correct ball over the other one in every one of the trials.

The surprising finding that octopi can learn from watching each other was recently published in the research journal *Science* by 2 biologists working at laboratories on the Italian coast, Professors Graziano Fiorito and Pietro Scotto.

The Surprise or Paradox Lead

This lead tries to arouse the reader's attention by making a surprising or paradoxical statement, and then follows up with the summary sentence. Here is an example:

> Biologists have for years spent many tedious hours training animals to perform simple tasks, by rewarding the desired behavior and punishing the undesired behavior. Now it seems that at least some animals may learn far more quickly by simply watching each other than by being trained by humans.
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> Two Italian scientists, Professor Graziano Fiorito and Professor Pietro Scotto, announced in a recent issue of the research journal *Science*, that the common octopus can not only be trained to distinguish between objects of different colors, but can in fact learn to make these distinctions even more quickly by simply watching each other.

Science Journalism in Action: An Example

No matter how it begins, the rest of the article expands on the summary that has preceded it. For the article to be effective for a general audience, you must be careful to explain to the reader what was done, why it was done, what happened, and why the result is interesting, avoiding big words whenever possible and carefully explaining any terms that are essential to the story. Remember, you are not trying to impress or bamboozle others; you are trying to teach them something. Here is an example that further develops the story on octopus learning. If this was your own work, of course, you would submit it to your instructor double-spaced. Note that paragraphs tend to be shorter here than in other forms of writing in biology:

> Two Italian scientists, Professor Graziano Fiorito and Professor Pietro Scotto, announced in a recent issue of the research journal *Science* that the common octopus can not only be trained to distinguish

between objects of different colors, but can in fact learn to make these distinctions even more quickly by simply watching each other.

They performed their study with *Octopus vulgaris* collected from the Bay of Naples, Italy. First they trained 30 individuals to grab a red plastic ball and 14 individuals to prefer a white plastic ball, by rewarding the animals with food if they chose correctly and mildly shocking the animals if they chose incorrectly. After 17–21 trials, the octopi all learned to make the correct choice, and no further training was necessary.

There is nothing unexpected so far: Biologists have been successfully training octopi to exhibit simple behaviors for many decades. The surprising part of the experiment came when the researchers then let each trained octopus exhibit its acquired color preference 4 times to a freshly caught octopus that had received no prior training.

The observing octopi were then themselves given the opportunity to select either a white or a red plastic ball. Remarkably, all but a few of the 44 observers chose the color preferred by the octopus it had watched. Just as remarkably, the color preferences shown by the observing octopi persisted for at least 5 days, when they were tested again.

Clearly, the octopus is a quick learner. And it learns more quickly from simply watching what other octopi do than it does by being shocked or rewarded by humans in the standard laboratory experiment. One wonders about the extent to which octopi can learn more complex behaviors from each other, and about the things octopi might actually be learning by example in their natural environment. Learning by example is apparently not a uniquely vertebrate characteristic; octopus see, octopus do.

JOURNALISM BASED ON AN INTERVIEW

An alternative to writing a piece of science journalism based on a published research article is writing a piece based on research that someone in your biology department is currently performing. Obviously, you need to get the professor's permission and cooperation to do this, and you have to do some preparation beforehand by reading some general textbook references about the research area being investigated, and perhaps by looking over a few papers that the professor has recently published. Allow about

1/2 hour for the interview, and have at least a half-dozen questions prepared in advance. Here are some possible questions to get an interview started:

What basic question are you asking in your research?

How did you start doing research in this area?

What do you enjoy most about doing research?

What is the most surprising thing you have found out so far?

How did you find that out?

Although biologists are generally eager to explain what they do and why they do it, most of us don't get much practice talking about our research to undergraduates—so don't be surprised if the biologist you interview is difficult to follow at first. If you don't understand something that the professor says to you, don't be embarrassed or afraid to ask for clarification. Any lack of understanding is sure to be apparent in what you write; **you can't explain something to someone else that you yourself don't understand**. And in science journalism, unlike some other forms of writing in biology courses, you can't hide your ignorance behind big words and convoluted sentence structures. **The success of your writing depends mightily on how hard you work to understand your source.** Along the way, you will learn a lot, meet some interesting people, and might even end up with something that you can publish in your campus newspaper or end up doing research in your interviewee's lab.

One good way to prepare for the interview is to read examples of science journalism in major newspapers and magazines, such as the *New York Times* and *Newsweek*. For each article, ask yourself, "What questions did the interviewer probably ask his or her subject in conducting the interview?" and "What additional questions would I ask if I got to talk to this person myself someday?" That sort of thinking puts you in exactly the right frame of mind for the real thing.

Here is an example of interview-based science journalism. See if you can determine what questions the student asked the person he was interviewing:

> "Don't worry, I'm on the pill," he said, to allay her contraceptive concerns. Such male contraceptive pills may be available in the near future, resulting from research being conducted by Professor Norman Hecht at Tufts University.
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> Over the past 20 years or so Professor Hecht has worked to understand how sperm develop, reasoning that the ability to block

their normal development in the testis could lead to an effective contraceptive pill.

As sperm develop within the testis, many new proteins must be synthesized in a particular order, or the sperm will not be able to function properly.

Hecht and his coworkers—4 postdoctoral fellows, 1 graduate student, and collaborators in 5 other research laboratories around the world—have so far isolated 7 of these sperm-specific proteins and are now studying the expression of the genes responsible for producing them. What turns the expression of these genes on at the appropriate time in sperm development? What turns the expression of these genes off at the appropriate time in sperm development? If he can disrupt the normal expression of the genes coding for those proteins, abnormal—and ineffective—sperm should result.

Sperm production can be attacked at a number of points in their development (called spermatogenesis), by interfering with either the transcription of genes from DNA, the storage of the resulting gene messages (called messenger RNA, or mRNA for short), or the translation of those messages into the final proteins.

The genes coding for the testis-specific proteins that Professor Hecht is interested in are transcribed from their DNA templates early in spermatogenesis and are then stored in the cytoplasm for many days before being translated into proteins. ''If we can prevent either the transcription of the genes or the subsequent translation of the mRNAs encoding these genes,'' says Professor Hecht with great enthusiasm, ''we should be able to prevent the development of normal, functional sperm.''

The great appeal of this approach, which Professor Hecht believes to be unique in the field, is that it should be possible to block sperm development without interfering with physiological processes elsewhere in the body.

One protein of particular interest to Professor Hecht is called contrin, which he and his coworkers discovered and isolated last year. Contrin binds to both DNA and mRNA. When it binds to DNA, it promotes transcription. Contrin also binds to mRNA, preparing it for long-term storage. Preventing germ cells from synthesizing contrin might therefore disrupt normal sperm development both by preventing certain transcriptional processes from occurring and by preventing the storage of mRNA molecules that are transcribed. No one yet knows how crucial contrin is for normal sperm development, but Professor Hecht expects to be the first to find out.

> Professor Hecht has recently isolated the genes coding for mammalian contrin, and has successfully synthesized contrin in the laboratory using the cloned DNA sequences. With unlimited quantities of pure contrin in hand, the next step will be to determine the precise 3-dimensional structure of the contrin molecule. It should then be possible to create artificially other molecules that bind specifically to contrin and disable it. Then it should be possible to prevent contrin synthesis in male mice and determine what happens to spermatogenesis in the absence of contrin.
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> This could be a first exciting step toward deliberately blocking the synthesis of crucial sperm-specific proteins indefinitely.
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> How much longer do men (and women) have to wait before male contraceptive pills become available commercially? "It will probably happen eventually," says Professor Hecht, "but not immediately."
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> "There are those in the United States and abroad," he says, "who believe the time and technology are right for widespread use of male contraceptives." It looks as though his laboratory will remain active for quite some time.

It is not difficult to see that the writer of this piece understands his subject well. And one certainly gets the impression that he enjoyed the assignment. In fact, I happen to know that he did.