CHAPTER 1

What Is Scientific Writing?

State your facts as simply as poss i ble, even boldly. No one wants flowers of eloquence or literary ornaments in a research article.

— R. B. McKerrow

THE SCOPE OF SCIENTIFIC WRITING

The term *scientific writing* commonly denotes the reporting of original research in journals, through scientific papers in standard format. In its broader sense, scientific writing also includes communication about science through other types of journal articles, such as review papers summarizing and integrating previously published research. And in a still broader sense, it includes other types of professional communication by scientists— for example, grant proposals, oral pre sen ta tions, and poster pres en ta tions. Related endeavors include writing about science for the public, sometimes called *science writing.*

THE NEED FOR CLARITY

The key characteristic of scientific writing is clarity. Successful scientific experimentation is the result of a clear mind attacking a clearly stated prob lem and producing clearly stated conclusions. Ideally, clarity should be a characteristic of any type of communication; however, when something is being said *for the first time*, clarity is essential. Most scientific papers, t hose published in our primary research journals, are accepted for publication precisely because they *do* contribute *new* knowledge. Hence, we should demand absolute clarity in scientific writing.

RECEIVING THE SIGNALS

Most people have no doubt heard this question: If a tree falls in the forest and there is no one t here to hear it fall, does it make a sound? The correct answer is no. Sound is more than pressure waves, and indeed there can be no sound without a hearer.

And similarly, scientific communication is a two-w ay pro cess. Just as a signal of any kind is useless u nless it is perceived, a published scientific paper (signal) is useless unless it is both received *and* understood by its intended audience. Thus we can restate the axiom of science as follows: A scientific experiment is not complete until the results have been published *and understood.* Publication is no more than pressure waves unless the published paper is understood. Too many scientific papers fall silently in the woods.

UNDERSTANDING THE SIGNALS

Scientific writing is the transmission of a clear signal to a recipient. The words of the signal should be as clear, simple, and well-o rdered as possi ble. In scientific writing, there is little need for ornamentation. Flowery literary embellishments— metaphors, similes, idiomatic expressions—a re very likely to cause confusion and should seldom be used in research papers.

Science is simply too import ant to be communicated in anything other than words of certain meaning. And the meaning should be clear and certain not just to peers of the author, but also to students just embarking on their careers, to scientists reading outside their own narrow disciplines, and *especially* to those readers (most readers today) whose native language is other than En glish.

Many kinds of writing are designed for entertainment. Scientific writing has a dif er ent purpose: to communicate new scientific findings. Scientific writing should be as clear and simple as pos si ble.

UNDERSTANDING THE CONTEXT

What is clear to a recipient depends both on what is transmitted and how the recipient interprets it. Therefore, communicating clearly requires awareness of what the recipient brings. What is the recipient's background? What is the recipient seeking? How does the recipient expect the writing to be org a nized?

Clarity in scientific writing requires attentiveness to such questions. As communication professionals advise, know your audience. Also know the conventions, and thus the expectations, for structuring the type of writing that you are doing.

What Is Scientific Writing?

ORGAN IZATION AND LANGUAGE IN SCIENTIFIC WRITING

Efective or ga ni za tion is a key to communicating clearly and efficiently in science. Such or ga ni za tion includes following the standard format for a scientific paper. It also includes organ izing ideas logically within that format. In addition to or ga ni za tion, the second principal ingredient of a scientific paper should be appropriate language. This book keeps emphasizing proper use of En glish because many scientists have trou ble in this area. All scientists must learn to use the Eng lish language with precision. A book (Day and Sakaduski 2011) wholly concerned with En glish for scientists is available.

If scientifically determined knowledge is at least as impor tant as any other knowledge, it must be communicated efectively, clearly, in words of certain meaning. The scientist, to succeed in this endeavor, must therefore be literate. David B. Truman, when he was dean of Columbia University, said it well: "In the complexities of cont emporary existence the specialist who is trained but uneducated, technically skilled but culturally incompetent, is a menace."

Given that the ultimate result of scientific research is publication, it is surprising that many scientists neglect the responsibilities involved. A scientist will spend months or years of hard work to secure data, and then unconcernedly let much of their value be lost b ecause of a lack of interest in the communication pro cess. The same scientist who will overcome tremendous obstacles to carry out a mea sure ment to the fourth decimal place will be in deep slumber while a typographical error changes micrograms per milliliter to milligrams per milliliter.

En glish need not be difficult. In scientific writing, we say, "The best En glish is that which gives the sense in the fewest short words" (a dictum printed for some years in the *Journal of Bacteriology*'s instructions to authors). Literary devices, meta phors and the like, divert attention from substance to style. They should be used rarely in scientific writing.