Why Scientists Can't Write

"Science is the great adventure of our age. It's ironic that its reports should be so dull to read," says novelist Michael Crichton, author of *The Andromeda Strain* and other works. In *American Scientist* (Jan.–Feb. 1991), he speculates about the source of this barrier between layman and expert.

I have often been struck by the fact that scientists in conversation are crisp and clear about their work. The same scientists, writing in a journal, produce a nightmare of incomprehensibility. Various explanations have been proposed, but I think the real problem may be structural: Scientific writing now demands a passive, abstract literary form.

In conversation, the scientist provides information in the way we ordinarily expect to receive it: as a narrative. "We had an unanswered question in our field. The question was important for these reasons. So we approached it in this way. Here's what happened when we did."...

Unfortunately, science has chosen to replace active personalized storytelling with passive abstract discourse. It's the difference between saying "I got up this morning and wrote a letter to American Scientist" *and saying "Letter-writing on some mornings may occur."*

Passive abstraction has many drawbacks. Since nobody in the real world communicates this way, it's an alien mode that we must shift into, like a foreign language. It's a struggle to write. It's agony to read. Particularly in reports of experiments, it doesn't reflect what actually happened. But most important, abstraction actually provides less *information than narrative, by removing the flavors, the feelings, the juice, and sometimes even the substance....*

Of course there are historical and intellectual reasons why scientists choose to depersonalize their reports. But the absence of the observer is no longer so fashionable a posture as it once was. It may be time for scientists to return to the more vigorous prose tradition of Galileo.

species of butterfly tasty to birds could thus protect itself. New research, however, indicates that it is scientists, not birds, whom the viceroy has been deceiving all these years, reports Tim Walker, an intern at *Science News*.

The butterflies' secret was revealed in an avian taste test conducted by David B. Ritland and Lincoln P. Brower of the University of Florida, Gainesville. The wingless abdomens of viceroys, monarchs, and other butterfly species were served up to local red-winged blackbirds. Despite the textbook wisdom, the birds found the viceroy just as unappetizing as the monarch. In fact, the birds frequently turned up their beaks after just one peck. The results "clearly refute the traditional hypothesis that viceroys are palatable Batesian mimics," Ritland and Brower said.

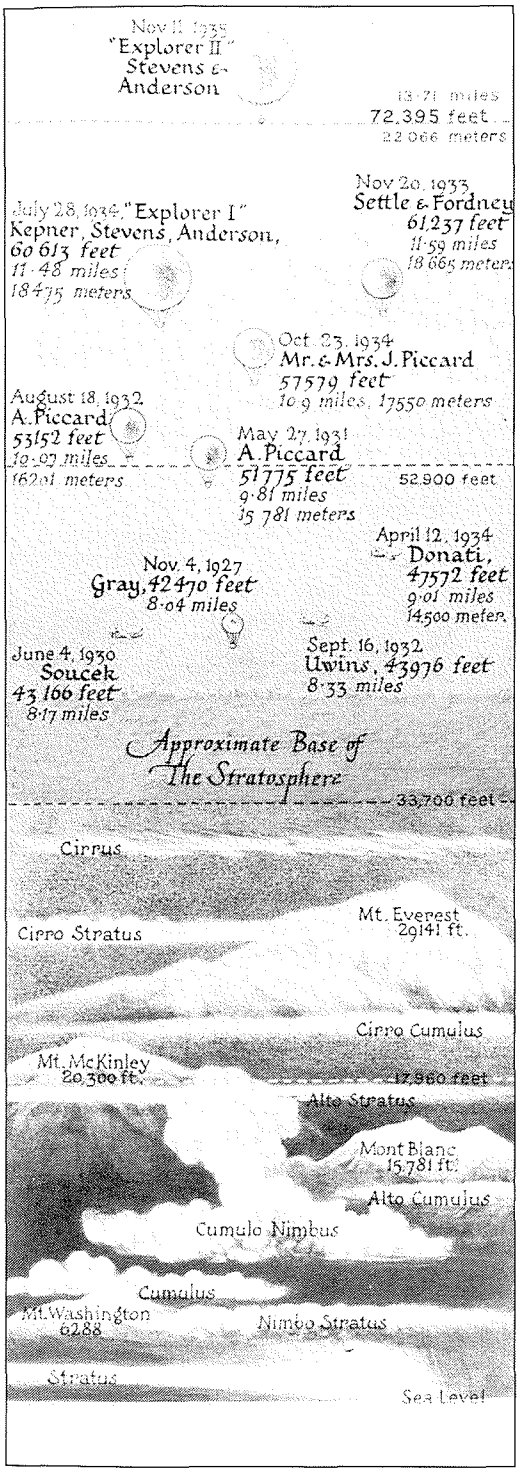
Why had scientists assumed that the viceroy was a taste treat? In part simply because the viceroy evolved from admiral butterflies, which are known to be tasty. But also because the viceroy, in its caterpillar stage, does not feed on poisonous plants—the only way, many biologists have believed, that a butterfly could acquire toxic chemicals. But the viceroy, it seems, knew better.

High Drama

"The Height of Ambition" by David H. DeVorkin, in *Air & Space/Smithsonian* (Apr.–May 1991), 370 L'Enfant Promenade S.W., 10th Fl., Washington, D.C. 20024.

In the 1920s and '30s, the stratosphere beckoned to both adventurers and scientists. But their interests in exploring it were not the same, and a conflict developed that foreshadowed the debate in later decades over manned versus unmanned exploration of space.

To prewar scientists, explains DeVorkin, curator of astronomy and space sciences at the National Air and Space Museum's department of space history, the stratosphere offered a chance "to solve the rid-



National Geographic *offered eager readers this scorecard on the "stratosphere race" in 1936.*

dle of the elusive 'cosmic ray,'" a mysterious form of highly penetrating radiation first detected in 1912. But—just as in the space age—finding answers to "arcane questions . . . couldn't fire public imagination and generate financial support."

What did capture the public's imagination was the spectacle of men in hydrogen–filled balloons daring to ascend into the perilously thin air of the stratosphere, which begins some seven miles above the earth's surface and extends for 24. To these bold explorers, ever intent on setting new records, "science was little more than an excuse to make bigger and better flights," DeVorkin says. Scientists who preferred use of unmanned balloons grew to resent the high-flying adventurers.

Swiss physicist Auguste Piccard (1884–1962) was an experienced balloonist who, as DeVorkin writes, "decided to make his mark in physics by combining his passions for flight and science: he would create a sealed, pressurized, manned laboratory that could be flown by balloon into the stratosphere to solve the mystery of the cosmic ray." Ascending from Augsburg, Bavaria, on May 27, 1931, Piccard and an assistant went up nearly 10 miles, a record. "The sky is beautiful up there—almost black," Piccard wrote in an account for *National Geographic*. The aeronauts ran into unanticipated difficulties in their descent but finally landed safely.

Piccard's flight made him a celebrity, but he had had time to make just one cosmic ray observation, and other scientists gave it little credence. By then, however, DeVorkin writes, "scientists using other means had found the origin of the cosmic ray to be indeed cosmic."

Four years later, the final flight of the era took place. Albert W. Stevens and Orvil Anderson of the Army Air Corps went up in *Explorer II* on Nov. 11, 1935, and set a new record of nearly 14 miles. Because an earlier flight in a hydrogen-filled balloon had ended with the balloon's explosion, the *Explorer II* balloon was filled with helium. This increased the margin of safety for the men aboard, DeVorkin says, but it also considerably reduced such

scientific value as the flight might have had. Because helium has less lifting capacity than hydrogen, half the scientific equipment that was supposed be aboard had to be dumped. As would become evident three decades later, the debate over manned-versus-unmanned exploration of the high frontier was far from over.

False Prophets

"Great Expectations: Why Technology Predictions Go Awry" by Herb Brody, in *Technology Review* (July 1991), Building W59, MIT, Cambridge, Mass. 02139.

It was the bright world of tomorrow. Solar cells and nuclear fusion were to provide pollution-free electricity, automobiles were to run on batteries, factories were to rely extensively on robots, and videotex terminals were to be important fixtures in American homes. But the technological future envisioned just a few years ago has failed to arrive, notes Brody, a senior editor of *Technology Review*. Innovations like nuclear fusion "seem, as always, to be at least a decade from practicality."

That's the way it usually goes with experts' technological forecasts, Brody says. And the result, he adds, is not just red faces but misspent scientific careers and misallocated money for research.

Why are the much-publicized predictions so often wrong? Several factors are involved, according to Brody. One is conflicts of interest. "Interested parties include not only the companies that stand to make money from a technology but also scientists whose funding grows and wanes with the level of public excitement." Researchers working on nuclear fusion, for instance, "have kept up a steady barrage of 'breakthrough' reports since the mid-1970s."

Consulting firms such as Dataquest and Business Communications, which analyze the business potential of emerging technologies, feed the bonfires of optimism. "Over the past decade," Brody writes, "outfits like these have foretold billion-dollar markets for artificial intelligence, videotex, and virtually every other new technology that laboratories have reported." Part of the problem is that the market researchers survey the wrong people: the new technology's vendors. Surveying potential buyers would make for more realistic projections, but also would be much more expensive.

The news media, of course, are ever willing to give hype a hand. Once published, the forecasts of "the experts" take on a life of their own.

False optimism about new technologies is also encouraged by underestimating the potential of old ones. "Theoretically, it's been possible for the past 25 years for computers to eliminate photographic film," says Du Pont executive Alexander MacLachlan. But thanks to continuing chemical refinements, he notes, silver-halide film has remained in the center of the picture.

"Any truly revolutionary technology defies easy prediction," Brody says. Computer designers in the mid-1970s still aimed to build ever larger behemoths. Few appreciated the value of personal machines. In fact, Brody says, from IBM's study then of what computer users said they wanted, the firm "reportedly concluded . . . that PCs would appeal only to a small group of hobbyists."

A Plague Of Scientists?

"Do We Need More Ph.D.'s, or Is Fewer Really Better?" by Constance Holden, in *Science* (Mar. 1, 1991), American Assoc. for the Advancement of Science, 1333 H St. N.W., Washington, D.C. 20005.

Some specialists are worried that the United States is producing too few scientists, but not Georgia State University economist Paula Stephan. She thinks there already are far too many of them, reports Holden, a *Science* writer.