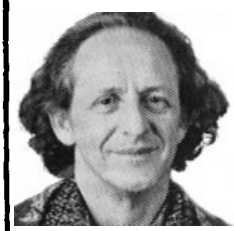

Current Comments

Scientific American — 136 Years of Science Journalism

Number 21 May 25, 1981

Several new publications have jumped on the now profitable bandwagon of popularizing science.[1-5] These magazines use fiction, fact, or fantasy to keep their readers aware of new developments and promises in science. To survive and prosper, they have to compete among themselves, as well as with older well-established publications, for their share of readers.

Probably one of the greatest success stories in science journalism is that of *Scientific American*, the granddaddy of popular science journals. Not only is the worldwide circulation of *Scientific American* over one million, but it enjoys the respect of science educators and researchers worldwide. My respected colleague and good friend Gerry Piel, publisher of *Scientific American*, gave me and my colleague Al Dorof several fascinating insights into the history and purpose of his magazine during a recent conversation in his office.[6]

Scientific American was founded in 1845 by Rufus Porter. This was only one of his many interesting accomplishments in art, journalism, and invention. Between 1825-1845, Porter painted more than 150 landscape scenes on the walls of rooms in New England homes. Porter's paintings were discovered and appreciated by Jean Lipman,[7] a leading critic and historian of American folk art. Porter's murals are highly valued today, and they are being peeled off the walls at considerable expense.[6]

Porter was also a very active and creative inventor. He designed and built horse-powered boats, revolving almanacs and calendars, corn shellers, washing machines, signal telegraphs and buoys, tubular steam engines, air pumps, cord-making machines, portable houses, industrial vises, fire alarms, grain weighers, and floating drydocks. He sold his design for a revolving-chamber rifle to Colonel Colt, the arms manufacturer, who later adapted it to his line of revolving pistols.[8]

Porter's mechanical talent led him to establish *Scientific American*. Encouraged by fellow inventors, Porter was determined, in his own words, "to furnish the intelligent and liberal working man and those who delight in the beauties of nature with a paper that will instruct while it diverts."[8] *Scientific American* included reports on scientific improvements, catalogs of American patents, "curious philosophical experiments," and essays on chemistry, architecture, and mechanics.[8]

Porter's energy and attention soon were diverted to an idea he thought of in 1834. He wanted to build an "aerial observatory"—a wood-framed, hydrogen-filled dirigible whose altitude was

controlled by a cable anchored to the ground. Porter believed the airship could navigate the skies eventually, powered by a steam engine and controlled by a rudder. He left it up to other enterprising individuals to make his idea a reality. But by 1846, no one had taken his idea off the drawing board. Porter decided to sell *Scientific American* so he could build his airship. Although a scale-model of the airship worked beautifully, construction of the actual ship was plagued by unfortunate natural accidents and vandalism.[8]

Scientific American fell into the hands of a family of patent lawyers when Porter sold it to Munn & Company in 1847. The Munn family published the magazine for the next 100 years. It was a standard, solid American institution until the Depression. During the Depression, *Scientific American* printed fewer reports on science and more press handouts for new products. The shortage of paper during World War II made any available advertising space valuable, and that revenue kept the magazine going a few more years. But the public image of *Scientific American* declined to the point where people would "find it on the newsstands, pick it up, look into it, and drop it into the next wastebasket."[6]

Piel recognized a mixed blessing in the sad, old *Scientific American*. While the magazine didn't satisfy the public's interest in science, that interest was still strong enough to make people keep buying *Scientific American* despite its shortcomings. Piel was particularly sensitive to the public's desire for more information on science. He was the science editor for *Life* magazine in the 1940s, under managing editor John Shaw Billings, grandson of the John Shaw Billings who developed the Surgeon General's library after the Civil War and founded *Index Medicus* in 1879.[9] He also served as the first director of the New York Public Library.

Grandson Billings made *Life* magazine a real news weekly that took its journalism, including science journalism, seriously.[10] Its "big picture-small word" format illustrated science topics in a way that captured the interest of the casual reader and did no violence to the subject matter. Piel soon realized that *Life*'s science department attracted its own audience, consisting mainly of scientists. Their response convinced him that "here was an audience hankering for better service than I could give them with...little words and big pictures."[10]

At *Life* magazine with Piel was Dennis Flanagan, who is now editor-in-chief of *Scientific American*. Piel and Flanagan decided to provide the audience of the *Life* science department with a better science journal by taking over *Scientific American* in 1947. The format of the new *Scientific American* was influenced by what they had learned at *Life*. Large and colorful pictures are an important feature of the articles in *Scientific American*. The pictures are designed to *explain* a scientific concept instead of just *displaying* it. Active scientists write and illustrate the text of the articles, in close collaboration with editors. At *Life*, the scientist did no more than check and approve the "little words" strung together by staff writers. Piel and Flanagan wanted the new *Scientific American* to be a magazine in which scientists would tell their own stories about their work.[6]

Besides Piel and Flanagan, there are 11 members of the board of editors. Although Piel takes an active editorial role, much of his time is devoted to the business and publishing side of the magazine. Piel describes the collaboration between author and editor as "painstaking and sometimes painful."[10]

He goes on to explain, "We assure the author that the editor working on the piece is the most earnest and careful and attentive reader he or she is going to find. If that editor has difficulties with the way the article is presented, the author is implored to listen to the editor and work together on the task."[6] The task is to explain scientific research to the interested layperson. Although the average *Scientific American* reader holds 1.5 degrees, they are all considered laypeople in fields outside their own.[10]

In effect, editors at *Scientific American* referee only the "readability" of an article. They assume that an article is factually accurate because the authors of the original scientific work and the authors of the *Scientific American* articles are the same. Few people would doubt the credentials of the authors listed in Table 1. In fact, it would be a rare case that a *Scientific American* author had not appeared on one of our lists of highly cited authors.

Of course, a readable article on science isn't necessarily "easy" to run through! Piel believes in Porter's original purpose for *Scientific American*—to "instruct while it diverts."[8] Piel doesn't shy away from giving his audience some very tough reading. Although it isn't an original research publication, *Scientific*

Table 1: *Scientific American* articles cited 25 or more times since publication.

Total Citations 1961 to Date	
72	**Allison A.** Lysosomes and disease. *Sci. Amer.* 217(5):62-72, November 1967.
72	**Atkinson R C & Shiffrin R M.** The control of short-term memory. *Sci. Amer.* 225(2):82-90, August 1971.
74	**Benzer S.** Genetic dissection of behavior. *Sci. Amer.* 229(6):24-37, December 1973.
53	**Bitterman M E.** The evolution of intelligence. *Sci. Amer.* 212(1):92-100, January 1965.
95	**Brower L P.** Ecological chemistry. *Sci. Amer.* 220(2):22-9, February 1969.
163	**Calhoun J B.** Population density and social pathology. *Sci. Amer.* 206(2):139-48, February 1962.
96	**Chisolm J J.** Lead poisoning. *Sci. Amer.* 224(2):15-23, February 1971.
180	**de Duve C.** The lysosome. *Sci. Amer.* 208(5):64-83, May 1963.
81	**Dickerson R E.** The structure and history of an ancient protein. *Sci. Amer.* 226(4):58-72, April 1972.
51	**Emmett J L, Nuckolls J & Wood L.** Fusion power by laser implosion. *Sci. Amer.* 230(6):24-37, June 1974.
51	**Fernstrom J D & Wurtman R J.** Nutrition and the brain. *Sci. Amer.* 230(2):84-91, February 1974.
78	**Garfield S R.** The delivery of medical care. *Sci. Amer.* 222(4):15-23, April 1970.
71	**Goldwater L J.** Mercury in the environment. *Sci. Amer.* 224(5):15-21, May 1971.
36	**Gordon R, Herman G T & Johnson S A.** Image reconstruction from projections. *Sci. Amer.* 233(4):56-68, October 1975.
45	**Green D E.** The mitochondrion. *Sci. Amer.* 210(1):63-86, January 1964.
50	**Gurdon J B.** Transplanted nuclei and cell differentiation. *Sci. Amer.* 219(6):24-36, December 1968.
57	**Haber R N.** How we remember what we see. *Sci. Amer.* 222(5):104-12, May 1970.
25	**Henisch H K.** Amorphous-semiconductor switching. *Sci. Amer.* 221(5):30-41, November 1969.
105	**Hess E H.** Attitude and pupil size. *Sci. Amer.* 212(4):46-54, April 1965.
54	**Heirtzler J R.** Sea-floor spreading. *Sci. Amer.* 219(6):60-70, December 1968.
67	**Herzenberg L A, Sweet R G & Herzenberg L A.** Fluorescence-activated cell sorting. *Sci. Amer.* 234(3):108-17, March 1976.
81	**Kimura D.** The asymmetry of the human brain. *Sci. Amer.* 228(3):70-8, March 1973.
54	**Mayer M M.** The complement system. *Sci. Amer.* 229(5):54-66, November 1973.
94	**Mosbach K.** Enzymes bound to artificial matrixes. *Sci. Amer.* 224(3):26-33, March 1971.
77	**O'Malley B W & Schrader W T.** The receptors of steroid hormones. *Sci. Amer.* 234(2):32-43, February 1976.
262	**Phillips D C.** The three-dimensional structure of an enzyme molecule. *Sci. Amer.* 215(5):78-90, November 1966.
30	**Rich A.** Polyribosomes. *Sci. Amer.* 209(6):44-53, December 1963.
53	**Rosenzweig M R, Bennett E L & Diamond M C.** Brain changes in response to experience. *Sci. Amer.* 226(2):22-30, February 1972.
29	**Stoeckenius W.** The purple membrane of salt-loving bacteria. *Sci. Amer.* 234(6):38-46, June 1976.
67	**Wallace R K & Benson H.** The physiology of meditation. *Sci. Amer.* 226(2):85-90, February 1972.
56	**Williams C M.** Third-generation pesticides. *Sci. Amer.* 217(1):13-7, July 1967.
78	**Zeeman E C.** Catastrophe theory. *Sci. Amer.* 234(4):65-83, April 1976.

American's articles are cited at a respectable rate. Table 1 lists those articles from *Scientific American* that have been cited 25 or more times since they were published. In fact, the impact or average citation rate for *Scientific American* articles is remarkable, considering that it isn't a primary research journal. During the six years we've published the *Science Citation Index*®'s *Journal Citation Reports*®, *Scientific American* consistently has had an "impact" greater than most primary journals. For this reason, it is not only covered in four editions of *Current Contents*® but also in the *Science Citation Index* and our computerized services such as *ASCA*® and *SCISEARCH*®. In the minds of many scientists, *Scientific American* is a review journal, in the best sense of the term.

Scientific American measures 8½ by 11½ inches, and the average issue has about 200 pages. Advertising accounts for 45 percent of the pages in an average issue. A full-page color ad costs $16,800 and a black-and-white ad sells for $11,200. *Scientific American* does not accept advertisements for cigarettes. Each issue contains eight articles. The board of editors works together to decide which articles will appear in a given issue of the magazine. They try to represent a "diversity of scientific disciplines" in each issue. Articles are selected from a back-file that includes enough completed assignments to fill seven or eight issues.[6]

The first article listed in the table of contents usually is concerned with a social, ethical, or political dimension of science; for example, "Acid rain" by Gene Likens,[11] "World coal production" by Edward Griffith,[12] and Matthew Meselson's "Chemical warfare and chemical disarmament."[13] The next two articles discuss "hot" areas of current research. Some examples are Frederic Chaffee's "The discovery of a gravitational lens,"[14] "The surface of Mars" by Raymond Arvidson,[15] and Walter Gilbert's "Useful proteins from recombinant bacteria."[16] These three news articles constitute the "front well" of the magazine. They are followed by *Science and the Citizen*, an editorial feature highlighting other current issues in science.

The last five articles make up the "rear well" of *Scientific American*. They represent the viewpoints of a diversity of disciplines in science. Some concentrate on a single topic, like "Ancient catapults,"[17] "Clay,"[18] and "Solitons."[19] Others represent a synthesis of various theories in a single field; for example, "The quantum theory and reality,"[20] "Supernovas and star formation,"[21] "The genetics of human cancer,"[22] and "The structure of the early universe."[23] Many describe the sequence of events that led up to an advance in scientific understanding, like "The origins of the water turbine,"[24] "Newton's apple and Galileo's *Dialogue*,"[25] and "The origins of the first powered, man-carrying airplane."[26]

Scientific American includes four other features in addition to *Science and the Citizen*. *50 and 100 Years Ago* reprints excerpts of text from past issues of the magazine. Martin Gardner contributes *Mathematical Games*, a witty and often amusing presentation of problems, puzzles, and proofs. Gardner retains the copyright to his feature and has produced a popular series of books derived from his columns. Philip Morrison reviews books on a wide variety of topics for *Scientific American*. He is the only part-time editor on the magazine's board of editors. Jearl Walker edits the *Amateur Scientist* department, which provides young researchers with a forum to express their interest and activity in science. These departments are

intended to entertain the reader with diverting reading. Piel explains, "When you publish a magazine, you have to give your readers something they can read in five or ten minutes and something that takes an hour or two."[6]

Scientific American also appears in six foreign language editions—Italian, French, German, Spanish, Japanese, and Chinese. In each foreign edition, the host country's editors provide their own news feature and one article. This gives the magazine a local "flavor." The combined circulation of all the foreign editions comes to about 300,000. The parent edition of *Scientific American* has over 700,000 circulation. About 80 percent of that circulation is generated by subscription, with the remaining coming from newsstand sales. A single copy of the magazine sells for $2.00, and a one year subscription costs $21.00. Subscriptions can be ordered by writing: *Scientific American*, P.O. Box 5919, New York, New York 10164.

For about the last 15 years, the September issue of *Scientific American* has been devoted to a single topic. Table 2 lists past single-topic issues of the magazine. These issues are later released as separate bound volumes, which have a significant "after-market" in college bookstores. For example, the 1979 issue on "The Brain" exceeded 250,000 single-copy sales, and it reached about 160,000 sales as a separate volume.[6]

Offprints of *Scientific American* articles are available singly or in a packaged collection of ten or more articles. Again, the offprints are made available through college bookstores. They are often required reading for many university courses. College professors compile reprint collections into books and include their commentary and notes. Table 3 lists some of the titles of these volumes. Offprint sales were an important source of income for the magazine. At its peak, about six million offprint copies were sold in a year! However, current sales have dropped to around one million. The drop in sales is a result of students and professors photocopying the original article or offprint. Of course, Piel regrets this illegal practice because stockholders are losing income and authors are deprived of royalties. But he acknowledges that at least "they are being put to the best conceivable purpose."[6]

A new member of the family is *Scientific American Medicine*, now in its third year of publication. It was created as an up-to-date supplement to medical

Table 2: Topics covered in past September issues of *Scientific American*, including dates of publication. These issues are available as separate bound volumes, published by W.H. Freeman & Co., San Francisco, California.

The Biosphere (1970)
The Brain (1979)
Cities (1965)
Communication (1972)
Economic Development (1980)
Energy and Power (1971)
Evolution (1978)
Food and Agriculture (1976)
The Human Population (1974)
Industrial Microbiology (available in November 1981)
Information (1966)
Life and Death and Medicine (1973)
Materials (1967)
Microelectronics (1977)
The Ocean (1969)
Solar System (1975)

Table 3: Selection of *Scientific American* readings collected from different issues. These volumes are introduced by various professors and researchers, whose names appear in parentheses. The books are published by W.H. Freeman & Co., San Francisco, California.

Continents Adrift and Continents Aground (J.T. Wilson)
Cosmology + 1 (O. Gingerich)
Ecology, Evolution, and Population Biology (E.O. Wilson)
Evolution and the Fossil Record (L.F. Laporte)
Human Ancestors (G. Isaac & R.E.F. Leakey)
Life: Origin and Evolution (C.E. Folsome)
Mathematics: An Introduction to Its Spirit and Use (M. Kline)
The Nature and Nurture of Behavior (W.T. Greenough)
The Physics of Music (C.M. Hutchins)
Recent Progress in Perception (R. Held & W. Richards)
Recombinant DNA (D. Freifelder)

textbooks that are often dated by the time they are published. *Scientific American Medicine* is a loose-leaf volume totaling 2,000 pages that covers 15 major areas of medical research—cardiovascular medicine, dermatology, endocrinology, gastroenterology, hematology, immunology, infectious disease, intensive and emergency care, metabolism, nephrology, neurology, oncology, psychiatry, respiratory medicine, and rheumatology.[6] It is written by about 30 authors from the faculties of the Harvard and Stanford Medical Schools. The editors are the deans in charge of continuing education at both medical schools.[6] Jonathan B. Piel, director of medical publishing, is in charge of *Scientific American Medicine*. His father reported this with noticeable pride.

Each month, the subscriber receives about 200 pages of new material with an updated index and bibliography. The new material is inserted into the appropriate sections, and the old material is discarded in order to maintain a "steady state" of about 2,000 pages. The material is practice oriented—writers report on any new understanding that changes the way medicine is practiced. Piel explains, "What comes along is not an *increase* in knowledge but a *change* in understanding."[6] Evidently, many physicians agree with Piel—more than 20,000 subscribe to *Scientific American Medicine*, and they renew their subscriptions at a rate of between 70-80 percent.[6] Naturally, I've been interested in this project because it is similar, in its basic concept, to our forthcoming encyclopedia, *Atlas of Science*.[27]

Scientific American and its sister publications have grown considerably since Piel took control in 1947. In order to produce the offprint publications and bound volumes, *Scientific American* bought the W.H. Freeman & Company publishing house.[6] In addition to the *Scientific American* publications, Freeman publishes many books in the biological, physical, and social sciences. Many of these volumes are accompanied by individual exercises and instruction handbooks.

Obviously, *Scientific American* is a publishing enterprise with a strong commitment to providing the public with creative and intelligent science information services. Piel welcomes the current boom in popular science magazines. He doesn't think that *Scientific American* has cornered the market on popularizing science. Instead, he believes there is enough interest to support several magazines with different editorial approaches. His only criticism of the new science magazines is that they aren't yet trying hard enough to really tell their readers about science. Piel observes, "They come in on the periphery and don't really tackle the interesting stories that are there to be told."[6]

Without doing an in-depth analysis of *Scientific American*'s coverage of computer and information science, I can't offer an authoritative opinion. But it is my impression that there are other subjects which interest the editors much more. I hope that the fields of science policy and information retrieval receive more regular treatment in the future. Nevertheless, *Scientific American* continues to tackle the tough but interesting stories in the advance of science. Piel and Flanagan carry on the tradition that Porter established in 1845—instruct and divert the layperson interested in science. Porter wanted to reach "those who delight in the beauties of nature."[8] Perhaps this is the reason behind *Scientific American*'s long and successful track record—Piel appreciates the beauty and elegance of an experimental

proof even more than many of the practicing researchers I know. He is the reader's most faithful broker and the author's best reader. Piel's enthusiasm for all of science makes him an excellent science journalist. *Scientific American* is one of the oldest and most important contributions to science journalism.

* * * * *

My thanks to Alfred Welljams-Dorof for his help in the preparation of this essay.

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