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ATTITUDES OF OAK RIDGE (MARTIN MARIETTA ENERGY SYSTEMS, INC.) SCIENTISTS AND ENGINEERS TOWARD SCIENCE NEWS IN LOCAL NEWSPAPERS

A Thesis

Presented for the

Master of Science

Degree

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Sally Ann Guthrie

May 1992

DEDICATION

This thesis is dedicated to N6721D

for teaching me perseverance and courage.

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ABSTRACT

This study presents the results of a survey of a random sample of scientists and engineers within Martin Marietta Energy Systems, Inc., in Oak Ridge, Tennessee. It concerns their attitudes toward the presentation of science by the media, particularly local newspapers. More than 470 responded to the questionnaire sent to them in January of 1992.

The literature review examines science from a philosophical and sociological perspective, gives a little of the history of the communication of science in the media, and reviews research on the topics of communicating science. Particularly, the review considers the view that scientists and journalists may be at opposite poles, a suggestion advanced by some; and it also examines criticisms leveled by both sides.

The questionnaire elicited opinions from the respondents on the presentation of science, attitudes about accuracy and headlines, the role of the press in communicating science, importance of information in stories, and the perceived attitudes of reporters and the press toward scientists.

The results of the survey indicate that the scientists and engineers in the study are critical of the presentation of science in local newspapers. They lay the blame on the media and suggest that things would be better if scientists were allowed to review articles before publication and if newspaper reporters had more training in science.

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CHAPTER 1

"'Let us content ourselves with being a select little band and not disclose our mysteries to the people."

-- Bernard Le Bovier de Fontenelle

INTRODUCTION AND OVERVIEW

Throughout the years both scientists and journalists have written and spoken of the relationship between the media and science, or more specifically, of reporters and scientists; and this relationship is not usually depicted as a smooth one. The situation always will be strained, presenting few opportunities for improvement, said Maurice Goldsmith in 1986. He wrote, "There is, always has been, and will continue to be, a gap of understanding between the scientist . . . and the non-scientist."[1] Others, however, in addressing the problems inherent in the interaction of the media and the scientists, have called for greater cooperation or, as Leon Lederman says, "an academic *perestroika* to bring together science and the humanities."[2]

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[1]Maurice Goldsmith, *The Science Critic: A Critical Analysis of the Popular Presentation of Science* (New York: Routledge and Kegan Paul, Inc., 1986), 4.

[2]Leon M. Lederman, "Physics for Poets," *Physics Today* 43 (July 1990): 9.

Even the popular press has addressed the issue. The major problem facing science today, according to a *Time* cover story, resulted from limited funds for research. The article suggested that scientists must expend more effort to educate Congress, the press, and the public about the benefits of some of its more esoteric work. This would enhance the image of the researchers in the eyes of the public and legislatures and would abet attempts to gain funding for worthwhile research.[3] Barbara Gastel advised that the media are "an influential source of scientific information for many who establish public policy."[4] A pamphlet published by the American Chemical Society told its readers that they "must actively seek public understanding by telling the story of their work and its significance." The recommendation was that the news media provide the best "tool" for communicating this message.[5] These citations present only a few examples, but a safe assumption is that scientists need the media today–perhaps more than ever before–to bolster their image, which in turn enhances the possibilities for obtaining funding.

According to Robert Snow, the scientific world has to ensure that any attempts to gain favor occur within the framework of the "media culture."[6]

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[3]Leon Jaroff, "Crisis in the Labs," *Time*, 26 August 1991, 51.

[4]Barbara Gastel, *Presenting Science to the Public* (Philadelphia: ISI Press, 1983), 21.

[5]American Chemical Society, *The Chemist and the Media* (Washington D.C.: American Chemical Society, 1984), 3.

[6]Robert P. Snow, *Creating Media Culture* (Beverly Hills: Sage Publications, 1983).

Goldsmith elaborated on this thought: "We live and conduct our activities in 'a media culture.' . . . the translation of science from the language of the laboratory can occur only under conditions laid down by the 'media culture.'"[7] The major problems faced by the newspaper journalist–if one asks the science reporter–are: (1) communicating science within the constraints imposed by the industry itself, that is, desires of readers, preferences of editors, deadlines, and limitations of technology, and (2) dealing with the scientific community and all of the difficulties associated with attempting to obtain information from a group that, for the most part, appears not to understand the role of the press.[8]

Undeniably, the communication of science to the public has become a major issue as people are becoming more involved in decisions involving science policy. Lederman stated, "Huge forces have been unleashed by the scientific progress of the 20th century. There is so little time and so much for the citizen to know and to understand if solutions are to be sanctioned by a democratic society."[9] Ronald Christensen echoed these thoughts: "The need to make informed scientific decisions has become an increasingly important part of our lives, and there is little reason to expect this trend to change. . . ."[10] Margareta

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[7]Goldsmith, 17.

[8]Sharon Dunwoody and Byron T. Scott, "Scientists as Mass Media Sources," *Journalism Quarterly* 59 (Spring 1982): 52.

[9]Lederman, 9.

[10]Ronald L. Christensen, "Scientific Literacy," *Transcript* 5 (December 1989): 8.

Cronholm and Rolf Sandell wrote ten years ago of the importance of communicating scientific information in light of what they saw as "two trends": the first, the "evergrowing demand for broader-based participation in decision-making on social issues; the other . . . the increasing technical complexity of the issues at stake in those decisions."[11] Further, Nancy Pfund and Laura Hofstadter indicated that science writers were "now facing the realization that they must incorporate political and social aspects into the more traditional framework of science news."[12]

Scientists today no longer have the luxury of "being a select little band not disclosing its mysteries,"[13] as Fontenelle wrote. Lynn White summarized the issue, "Science must have a positive emotional context to thrive, as well as economic and political encouragement. Legislatures and corporate bodies must reach decisions favorable to science, and investors and voters must approve what their representatives do."[14] Meg Greenfield, however, posed an interesting view that whenever there is an admission of uncertainty related to science, a host of editorial warnings appear about "how the nation and its leaders must learn science while there's time or it's curtains for the democratic process." Greenfield further

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[11]Margareta Cronholm and Rolf Sandell, "Scientific Information: A Review of Research," *Journal of Communication* 31 (Spring 1981): 85.

[12]Nancy Pfund and Laura Hofstadter, "Biomedical Innovation and the Press," *Journal of Communication* 31 (Spring 1981): 150.

[13]Bernard Le Bovier de Fontenelle, *Entretiens sur la pluralite des mondes,* in Goldsmith, 4.

[14]Lynn White, Jr., "Science, Scientists, and Politics," in *Science and Society Selected Essays*, eds., Alexander Vavoulis and A. Wayne Colver (San Francisco: Holden-Day, Inc., 1966), 70.

asked, "Is radiophysics, like democracy, really everybody's job?"[15] There are, indeed, a number of ways to examine the issue. The idea of greater cooperation is central to this study, as cooperation is seen as an important beginning. Scientists must cooperate with the media to get their message to the public, and the media must cooperate with the scientists to gain access to news that is important economically, politically, and socially.

Nonetheless, the chore of communicating science to the public–an undefined public, at that–often falls upon the journalist.

PURPOSE

The purpose of this study was to examine the perceptions of scientists employed within Martin Marietta Energy Systems in Oak Ridge, Tennessee; to ascertain their attitudes toward the print media, particularly local newspapers; and to determine what assumptions these scientists have made about how the press works. The goal was to document suggestions for promoting greater cooperation and understanding between scientists and the media. This effort, it is hoped, will provide additional insight into what appears to be a complicated relationship.

Some critics of science journalism have identified an additional problem: the great need for journalists to subject scientific research to scrutiny, to stop accepting on faith the pronouncements of the scientists, and to portray scientists

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[15]Meg Greenfield, "Science Goes to Washington," in *The Politics of Science*, ed., William R. Nelson (London: Oxford University Press, 1968), 132-133.

as fallible human beings rather than the "arbiters and solvers of the nation's problems."[16] This study attempted to look at criticisms levied against the media by the scientists and criticisms of the scientists advanced by the journalists. Is the problem of communication a manifestation of the polarity identified in the "two cultures" of C. P. Snow?[17] Perhaps, Dorothy Nelkin expressed the problem best: "Why is science writing so uncritical of science? And why are scientists so critical of the press, so convinced of its anti-science intent?"[18] Additionally, what do scientists have to say about the role of the media in criticizing science?

As Nelkin further noted, there has been a serious lack of analysis of the interactions of the "two influential social institutions"[19] of science and the press. This paper seeks to contribute to rectification of this oversight.

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[16]Carol H. Weiss and Eleanor Singer, eds., *Reporting of Social Science in the National Media*, (New York: Russell Sage Foundation, 1987), 61.

[17]C. P. Snow, *The Two Cultures: And A Second Look*, (New York: Mentor, 1963).

[18]Sharon Dunwoody, Sharon M. Friedman, and Carol L. Rogers, eds., *Scientists and Journalists: Reporting Science As News* (New York: Free Press, 1986), 30.

[19]Dorothy Nelkin, *Selling Science: How the Press Covers Science and Technology*. (New York: W. H. Freeman, 1987), x.

DEFINITION OF TERMS

Thomas Kuhn defined "normal science" as "research firmly based upon one or more past scientific accomplishments."[20] J. Bronowski added that "science is a highly integrated form of knowledge which makes a world view."[21] Richard Barke defined science as "both a method by which knowledge is gained and the knowledge that results from that process."[22]

There is some disagreement, however, about how to distinguish between applied science and basic science. Vannevar Bush wrote that the goal of basic science is to generate "general understanding of nature and laws," while applied science is "undertaken with a particular objective." Technology is sometimes considered to be applied science, frequently making it even more difficult to ascertain where technology ends and basic science begins. Derek de Sola Price said that the distinction between science and technology was made when scientists "want to get money . . . to get out of responsibility . . . or to get status."[23] Hillier Krieghbaum, however, defined science according to the disciplines that comprise it, rather than by what it is. He used the term "science" as an all-inclusive one

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[20]Thomas S. Kuhn, *The Structure of Scientific Revolutions* (Chicago: The University of Chicago Press, 1970), 10.

[21]J. Bronowski, *Magic, Science, and Civilization* (New York: Columbia University Press, 1978), 39.

[22]Richard Barke, *Science, Technology, and Public Policy* (Washington, D.C.: CQ Press, 1986), 6.

[23]Barke, 7.

consisting of "'pure' science or basic research, applied science or development, technology, engineering, medicine, and public health."[24]

Benjamin alluded to the difficulty of defining science because of two problems. The first is semantic; that is, words mean what we want them to and are flavored by a history of meaning. The second difficulty arises because the word "has become a term of praise: the scientific way of doing things is the 'best' way." Therefore, he contended, the word has taken on emotional significance so that "When anything calls itself 'science,' beware!"[25] Appropriately forewarned, this paper combines the definitions of Barke and Krieghbaum. Science is considered as the process by which knowledge is gained, the resulting knowledge from that process, as well as the application of that knowledge. "Technology" is also included in this broad definition of science.

What then constitutes science news? Science news was described by Bruce J. Cole as those news stories which contain as a major part of their subject matter "results or interpretation of empirical research in the sciences."[26] In this study, science news consists of the scientific process, scientific knowledge, and its application that constitute the major part of a story appearing in a newspaper for the edification and enjoyment of the reading public.

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[24]Hillier Krieghbaum, *Science and the Mass Media* (New York: New York University Press: 1967), 2.

[25]Benjamin, 10.

[26]Bruce J. Cole, "Trends in Science and Conflict Coverage in Four Metropolitan Newspapers," *Journalism Quarterly* 52 (Autumn 1975): 467.

The practitioners of science, the scientists themselves, were classified according to two of the three categories defined by Sharon Dunwoody and Byron T. Scott. That is, the applied sciences are engineering, medicine, computer and information sciences, geodetic science, food sciences, natural resources, pharmacy, nursing, allied medicine and agriculture. Physical and life sciences are biological sciences, astronomy, biochemistry, biophysics, botany, chemistry, geology, mathematics, statistics, and physics. Social science, the third category defined by Dunwoody and Scott,[27] was not used in this study because the population under consideration did not contain enough scientists in these disciplines from which to draw an adequate sample.[28]

The East Tennessee Resource Valley is touted as ranking among "the nation's finest research environments, offering commercial and educational opportunities in science and technology." Generally, the organizations considered to be the mainstays of this scientific environment are the Oak Ridge National Laboratory, the University of Tennessee, and the Tennessee Valley Authority. Promotional literature from the Oak Ridge-Knoxville Technology Corridor group, known as the Tennessee Technology Foundation, stated that "over 2,500 Ph.D.'s in science and engineering call our valley home." Further, the area was said to have a

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[27]Dunwoody and Scott, 55.

[28]For a look at a sociological study of scientists and engineers in Oak Ridge, see Lynn E. Dwyer, "The Social Backgrounds of Scientists and Engineers in Oak Ridge, Tennessee, and Huntsville, Alabama," (M.S. thesis, University of Tennessee, 1972).

labor force of over 20,000 geared to high-tech specialties.[29] The *Knoxville News-Sentinel* described this organization as "an industrial marketing association serving 15 counties in middle East Tennessee."[30] For purposes of this project, the East Tennessee Resource Valley will be considered as the geographic area in which the scientists participating in this study live and conduct their work, primarily within Martin Marietta Energy Systems, Inc., in Oak Ridge.

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[29]"Oak Ridge-Knoxville Technology Corridor," promotional pamphlet of the Tennessee Technology Foundation.

[30]"Henry is president of Resource Valley," *Knoxville News-Sentinel*, 17 August 1991, C6.

CHAPTER 2

"Since Johannes Gutenberg first printed the Bible in 1456, over thirty million different titles have been printed. Roughly ten million books are contained in the main branch of the New York City Public Library. Widener Library at Harvard, the largest university library in the United States, holds over nine million volumes."
-- Kenneth W. Houp

BACKGROUND AND METHODOLOGY

Among the earliest science critics was Jonathan Swift, who used satire to express his skepticism of the "new science." As a matter of fact, Alan G. R. Smith alleged that one particular episode in *Gulliver's Travels*, the one in which Swift described the flying island of Laputa, was a brutally satirical attack on scientists in general and the Royal Society in particular. This was in 1726. According to Smith, "Swift like so many laymen of the time, was convinced of the 'uselessness' of the scientific and mathematical learning which had developed so rapidly in the seventeenth century and had received widespread general publicity with the founding of the Royal Society."[31]

Joseph Addison, too, used the pages of his periodical the *Spectator* to denounce the exaggerated expectations of the new science and to depict scientists

[31]Alan G. R. Smith, *Science and Society in the Sixteenth and Seventeenth Centuries* (London: Thames and Hudson, Ltd., 1972), 171.

as so absent-minded and impractical that "they forgot the realities of the world about them."[32]

The type of activity that today is called "scientific" developed rather suddenly in the seventeenth century, according to John Z. Young. He pointed to the invention of printing as a "landmark in the history of human communication" that was "crucial for the development of scientific behavior."[33] Smith, too, described the important role played by printing in the development of science: "There was no guarantee that important scientific work done in one part of medieval Europe would be readily available in other parts of the Continent. Printing changed all that."[34]

Smith added that although Swift, Addison, and others attacked the scientists, giving them "a bad press," the educated classes in England at the end of the century were interested in scientific ideas and discoveries, reading not only such satirical works but also an increasing number of books in which the scientists "expounded and sometimes even attempted to popularize their ideas."[35]

At the beginning the seventeenth century, scientists were beginning to stress the need for rational explanations, thereby leading to a rejection of beliefs in miracles, witchcraft, and astrology. Concurrently, the belief of many educated

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[32]Smith, 173.

[33]John Z. Young, "Changing Symbols of Science," in Vavoulis and Colver, 31.

[34]Smith, 62.

[35]Smith, 173.

citizens in the traditional doctrines of Christianity was weakening. The new scientific ideas were spread by the publications of learned societies and by the increasing number of scientific books which the educated members of western European society read avidly.[36]

Krieghbaum speculated that the first reporting of science news by an American periodical was in *Publick Occurrences, Both Foreign and Domestick*, published by Benjamin Harris on September 25, 1690. Some consider this to be the first American newspaper.[37] Two paragraphs in this publication were devoted to news about an outbreak of smallpox in Boston. Krieghbaum believed that this story demonstrated some of the concepts of science reporting seen today: (1) It dealt with public health and medicine; (2) It stressed the local angle; (3) It emphasized progress in that the death rate in the present epidemic was less than that of the previous outbreak; and (4) It was tied to the military.[38]

James Secord said that "popular science" in the form that we recognize it today was resulted from two happenings: the French Revolution and the early stages of industrialization. The press in the 1800s reported of experiments by Andrew Crosse allegedly showing that life was created by electricity. Although the flaws were in the science of Crosse, Secord saw this as an illustration of the power

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[36]Smith, 176.

[37]Michael Emery and Edwin Emery, *The Press and America, Seventh Edition* (Englewood Cliffs, N.J.: Prentice-Hall, 1992), 20.

[38]Krieghbaum, 18-20.

of the press because hundreds of newspapers and periodicals throughout the world "greedily took up the announcement" that Crosse had created life in the form of mites while performing an electrical experiment.[39]

According to Dunwoody, Friedman, and Rogers, science news did not regularly appear in the media prior to the World War I . The first world war was responsible for a tremendous toll in human casualties and massive devastation created by the weapons of war, which came under the realm of science information. Because the public had an interest in these matters, the American Chemical Society established a news service in 1919, the first of its kind in this country. E. W. Scripps followed in 1921 with his own science news service, which sold stories of science to newspapers across the country. One could not say that science news burgeoned during this time nor that science writers proliferated. However, coverage of science news increased modestly. The years following World War II saw a much greater expansion of science coverage in the press; and finally, the launching of the Soviet satellite *Sputnik* in 1957 contributed enormously to the heightening of public interest in science.[40]

The public expressed an increasing concern in the 1960s and 1970s for the environmental and social risks posed by science and technology. Attention moved from the marvels of invention and discovery to the consequences and, as Benjamin

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[39]James A. Secord, "The curious case of *Acarus crossii*," *Nature* 345 (June 7, 1990): 471-472.

[40]Dunwoody, Friedman, and Rogers, xiii-xv.

said, "from the celebration of progress to a more critical reflection about the problems brought about by technological change."[41]

Where is science today? Goldsmith writes that "we are at the beginning of the age of public participation in science."[42] A *Time* article presents the picture from the standpoint of a news magazine saying that science is under siege because of tight money, blunders, and scandal "beset by budget squeeze, cases of fraud, relentless activists and a skeptical public." Christine Gorman further characterized the problem, explaining that once upon a time "scientific knowledge was considered objective and unassailable." Today, things have changed, and it is "often hard to tell where science stops and economics and politics take over."[43]

THE TWO CULTURES

Throughout the literature concerned with the media and science are references to the "two cultures" portrayed by C. P. Snow. In a lecture delivered in 1959, Snow suggested that "the intellectual life of the whole of western society is increasingly being split into two polar groups . . . at one pole we have the literary intellectuals . . . at the other scientists, and as the most representative, physical scientists."[44] With a view typical of one held by many in the scientific community,

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[41]Benjamin, 10.

[42]Goldsmith, 12.

[43]Christine Gorman, "The Double Take on Dioxin," *Time*, 26 August 1991, 52.

[44]C. P. Snow, 11-12.

Snow heaped greater criticism on the intellectual impoverishment of the literary culture for being unable to describe the Second Law of Thermodynamics than on the scientific culture for its unfamiliarity with the structure of an apokoinou in a literary work. This is not meant to denigrate science, but to point out the elitist attitude held by many scientists. The science journalist must work within this elitist environment. Peter Farago called it "treading a tightrope between the concerns of the public and those of the scientist, especially when, as it frequently happens, there is a genuinely and sincerely felt antithesis."[45]

Others have echoed the "two-culture" line of thought. According to Dunwoody and Scott, "Science journalists have emphasized the 'chasm' that many of them perceive between themselves and their scientific sources."[46] Bennett recognized the two extremes but presented a contrasting view that "readers probably know even less of history or literature than they do of science."[47] Krieghbaum also promoted the idea that the general public understands neither the scientific nor the traditional culture.[48] And finally, Warren Burkett explained, "Science writing helps bridge the gap between scientists and non-scientists. Such is the world of the two cultures seen by C. P. Snow."[49]

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[45]Peter Farago, *Science and the Media* (London: Oxford University Press, 1976), 12.

[46]Dunwoody and Scott, 52.

[47]Dunwoody, Friedman, and Rogers, 120.

[48]Krieghbaum, 56.

[49]Warren Burkett, *News Reporting: Science, Medicine and High Technology* (Ames, Iowa: The Iowa State University Press, 1986), 3.

Farago, however, considered the view that the difficulty of communicating science goes beyond two cultures, beyond educational and intellectual attainment. The problem relates to the "emotive" aspects of science. "The truth is that large areas of science are tedious . . . and it would be untrue to suggest that scientists are enthusiastic about all aspects of even their own fields."[50] Gastel attributed part of the problem of communicating science to the uncertainties posed by science. Although a "tidy" story would be preferred by both journalists and scientists, this is not the way of science. She stated that "depicting the gaps and uncertainties is crucial in presenting science to the public."[51]

Why is there tension between scientists and the press? The problem must be largely ascribed to the fundamental differences in the perceptions of what is news and how it should be presented. The statement of one pundit illustrates the nature of the problem, at least from the perspective of the scientist: "Scientists want to get it right; reporters want to get it today."[52] Gastel noted that newsworthiness often depends on "the proper balance of familiarity and novelty."[53]

John Timpane attempted to dispel the idea of polarity between science and the arts by saying that the two lie on the same continuum. He said, "They do not

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[50]Farago, 42-43.

[51]Gastel, 39.

[52]Dunwoody, Friedman, and Rogers, 78.

[53]Gastel, 30.

compete; they connect."[54] Michael Ryan also noted that the attitudes of scientists and science journalists toward science news coverage were "remarkably similar."[55]

THE PUBLIC FOR SCIENCE

In their study of the knowledge gap hypothesis, C. N. Olien, P. J. Tichenor, and G. A. Donahue examined science literacy in various segments of the population and found that science knowledge was related positively to the amount of education a person had acquired and that media coverage merely served to widen gaps between the more and less knowledgeable. That is because the media function much as other social institutions in reinforcing or increasing existing inequities. They concluded that science news is illustrative of one problem: the tendency for media coverage to wane before the knowledge gaps closes. This, they said, "may be especially apparent in science, where a new development or finding renders yesterday's news topics obsolete." They further stated that the prognosis for closing the knowledge gap in science was "dismal."[56]

Jon D. Miller and Thomas M. Barrington noted that about half of the adult population claimed to be interested in scientific issues, but results of a survey designed to provide insight into knowledge of science information showed the

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[54]John Timpane, "Essay: The Poetry of Science," *Scientific American* 265 (July 1991), 128.

[55]Michael Ryan, "Attitudes of Scientists and Journalists Toward Media Coverage of Science News," *Journalism Quarterly* 56 (Spring 1979): 26.

[56]P.J. Tichenor, G.A. Donahue, and C. N. Olien, "Mass Media Flow and Differential Growth in Knowledge," *Public Opinion Quarterly* 34 (1970): 170.

"dismal" results predicted by Olien, Tichenor, and Donahue. This occurred despite the fact that citizens of the United States at this time in history are "exposed to more scientific and technological information than any people to ever inhabit this planet."[57] James E. Grunig, too, observed that science news reaches only a select public that is more likely to express awareness of a scientific issue than any understanding of it. The major factor in whether or not a person retained any knowledge of scientific subjects was the perceived relevance of the topic to the reader.[58]

Although findings demonstrate relative ignorance of scientific news on the part of the masses, researchers have found that the public expresses a desire for more information about science and medicine. Joy Patterson's study of young adults between the ages of 18 and 34 revealed strong support for science but a concern about how science and technology would be used in society. They expressed dismay that science might be used to build a bomb to annihilate them.[59] Clyde Z. Nunn also noted that increasing numbers of readers were desirous of more coverage of science and technology.[60] Gerald Hinkle and

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[57]Jon D. Miller and Thomas M. Barrington, "The Acquisition and Retention of Scientific Information," *Journal of Communication* 31 (Spring 1981): 178.

[58]James E. Grunig, "Three Stopping Experiments on the Communication of Science," *Journalism Quarterly* 51 (Autumn 1974): 387.

[59]Joy Patterson, "A Q Study of Attitudes of Young Adults About Science and Science News," *Journalism Quarterly* 59 (Autumn 1982): 406-413.

[60]Clyde Z. Nunn, "Readership and Coverage of Science and Technology in Newspapers," *Journalism Quarterly* 56 (Spring 1979): 30.

William R. Elliott determined that the supermarket tabloids had successfully tapped a market for health news, a factor that they thought the daily newspapers should note.[61]

An earlier study by the National Association of Science Writers (NASW) determined that the readers of science news were somehow different from the general public: "Science readers are very much interested in the world around them . . . attuned to a broad range of events. Their vista is not limited to local events, but reaches out to the nation and international level."[62] The study concluded that education, sex, and economic status were the major social factors determining who would consume science news in the newspaper and that recall of science news was greater for those who had studied science in school.[63] Their composite science consumer was more likely to be an urban dweller, above average in income and education, female if the subject matter were medicine, male for other science news, and generally a user of all media with a preference for the written.[64]

This 1957 NASW study (before the dominance of television) attempted to determine the demand for science news in the media and to ascertain what types

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[61]Gerald Hinkle and William R. Elliott, "Science News Coverage in Three Newspapers and Three Supermarket Tabloids," *Journalism Quarterly* 66 (Summer 1989): 358.

[62]National Association of Science Writers, Inc., *The Public Impact of Science in the Mass Media* (University of Michigan: Institute for Social Research, 1958), 57.

[63]Ibid., 64, 156.

[64]Ibid., 223-224.

of science news was read. Their content analyses and reviews of previous studies revealed that only a small part of the available science news actually made it to the media.[65] This study predicted that there might possibly be a post-*Sputnik* boom in science news, but even then, these researchers believed that the science news that would actually see print in popular news media would be small in comparison to what was available.

Closer to home, a study in 1975 gathered information about the community of Oak Ridge through a mail survey to determine media use and attitudes toward the local newspaper, the *Oak Ridger*. Findings in that research that possibly have relevance to this paper were that citizens of Oak Ridge had a high interest in health news and that newspapers were the primary source of news. An open-ended question about what the readers particularly liked about their newspaper did not produce "science news" as an answer. Questions about the newspaper's "image" revealed that the respondents rated it lowest on "accuracy in reporting fact."[66] This complaint is also registered by scientists, as will be shown in following pages.

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[65]Ibid. p. 1.

[66]Carl W. Goodman, "Survey of Media Habits in a High-Status Scientific Community, Oak Ridge, Tennessee" (M.S. thesis, University of Tennessee, 1975), v, 74, 85, 94.

CRITICISM OF THE MEDIA

The mass media are often castigated for the way they communicate science to the public. This criticism ranges from the more general: "They seldom place innovations in a broader context, rarely explain the methods by which science proceeds, and almost never relate science news to policy questions"[67] to the more specific complaint that the most frequent inaccuracies occur in headlines. June Goodfield noted that many scientists believe that the media "always will present the public with simplistic stories rather than struggle to explain complicated truths."[68] The media are also criticized because they tend to present both sides of controversial issues which, in the case of many scientific endeavors, "grants legitimacy to eccentric or unproven theories."[69] Many have charged that science in the press becomes a form of sport, a race between scientists in different disciplines and between competitive countries to see who can be first, best, most, or worthy of other superlatives.

Allan Mazur charged that there is a bias in the selection of science news that appears in the press. This bias favors research in those sections of the country where the science writing "inner club"[70] plies its trade. He further charged that

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[67]Barke, 123.

[68]June Goodfield, *Reflections on Science and the Media*, (Washington D.C.: American Association for the Advancement of Science, 1981), 7.

[69]Marcel C. LaFollette, "Scientists and the Media: In Search of a Healthier Symbiosis," *The Scientist* 4 (9 July 1990): 15.

[70]Sharon Dunwoody, "The Science Writing Inner Club: A Communication Link Between Science and the Lay Public," *Science, Technology, and Human Values* 5 (1980): 14-22.

the media shape the public's perception of science and technology by the quantity of coverage. This, he said, can have as much effect as the substance of the revelation. It is his view, then, that the conservative views of the public toward technical innovation are enhanced when the media focus on controversy in science stories. He elaborated by explaining that when there is doubt about safety issues, the public prefers to err on the side of safety and will reject technology.[71] Cronholm and Sandell argued that the media may in fact be alienating the very people they are attempting to serve by the nature of the coverage of such controversial stories as nuclear power and fluoridation.[72]

One criticism levied by Nelkin is that "too often science in the press is more a subject for public scrutiny, more a source of entertainment than of information." Science journalists present a narrow range of coverage, according to Nelkin, and are, in effect, "retailing science and technology more than investigating them."[73] They do not scrutinize scientific statements, but rather tend to polarize, popularize, and personalize the work of the scientists that they do cover. Farago described the science journalist as "caught between opposing forces."[74] The

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[71]Allan Mazur, "Media Coverage and Public Opinion on Scientific Controversies," *Journal of Communication* 31 (Spring 1981): 107-115.

[72]Cronholm and Sandell, 94.

[73]Nelkin, 263, 265.

[74]Farago, 50.

emotional contact he or she establishes with the readers will cause conflict with the very scientist whose favor the journalist must curry.

Goodfield observed, "In these times of active social change and active social questioning, many scientists have responded as if facing threats rather than challenges."[75] Scientists accuse the media of setting the agenda for science, yet these same scientists know that favorable publicity can be all-important to obtaining funding for a pet project. Burkett argues that science is misrepresented when the newspapers "regularly choose to write on the bizarre, the unusual, the exceptional. . . ."[76] Goodfield says that frequently the public is not exposed to science fairly because of the "*mass media's selection* (emphasis is hers) of science news events."[77] Some have advanced the argument that the media give the public what it wishes. "Thus there is a natural tendency to emphasize the limitations of science in action, or–in plain language–the lure of a good scare story is seldom resisted."[78]

Accuracy, or the lack of it, is another issue concerning both scientists and journalists. James W. Tankard and Michael Ryan found that scientists' perceptions of accuracy of science stories in the media were not very favorable to the media. The scientists they studied expressed the usual, negative views of headlines on

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[75]Goodfield, 7.

[76]Burkett, 133.

[77]Goodfield, 39.

[78]Farago, 70.

science stories. These scientists also believed that science stories sometimes omitted information crucial to the understanding of the stories, thereby making science stories misleading.[79] Ryan's factor analysis of responses to the Tankard and Ryan study lent support to an earlier hypothesis advanced by Fred C. Berry, Jr.,[80] that scientists' identification of inaccuracies in coverage of science would fall into two categories: (1) those caused by deviation from objective fact; and (2) those caused by reporters' mistakes in judgment.[81] Ira Flatow said that the scientists' claims of inaccuracy in science stories may result from differences in beliefs about the point of view that a story takes. That is, the "implications (of the research) are at issue."[82] The American Chemical Society, however, advised its members that accuracy may have different meanings to scientists and to reporters. Their guide for chemists who deal with the media cited an example that the omission of a name may be of utmost importance to a scientist, but yet be unimportant in the journalistic context.[83] A study by D. Lynn Pulford indicated that if errors occurred, they were more likely to be caused by the omission of what

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[79]James W. Tankard, Jr., and Michael Ryan, "News Source Perceptions of Accuracy of Science Coverage," *Journalism Quarterly* 51 (Summer 1974): 334.

[80]Fred C. Berry, Jr., "A Study of Accuracy in Local News Stories of Three Dailies," *Journalism Quarterly* 44 (1967): 482-90.

[81]Michael Ryan, "A Factor Analytic Study of Scientists' Responses to Errors," *Journalism Quarterly* 52 (Summer 1975): 333-336.

[82]Friedman, Dunwoody, and Rogers, 104.

[83]American Chemical Society, 26.

was thought to be crucial information for interpreting the stories.[84] The problem of omission of details from stories was also identified in the Tankard and Ryan study which established 42 kinds of errors ranging from the omission of relevant information about the method of the study to misspelling names and scientific terms.[85] Jonathan T. Rich used a quantitative method to examine science news coverage in newsmagazines and found that each magazine had a different emphasis and therefore omitted different details.[86]

Ryan used the coorientation model to examine how scientists and science writers viewed science news in the media. Coorientation attempts to measure attitudes toward an object by requiring that members of the groups under study predict the responses of the other group. Three variables result: agreement, congruency, and accuracy. Ryan's conclusion was that the view of the two groups is "remarkably similar." He noted significant differences in the mean scores for agreement between the two groups; but when agreement responses on the Likert scale were dichotomized, the two groups appeared on the same side of the agree/disagree scale. Even though the mean scores for congruency–that is, the extent to which the attitudes of the people in one group are similar to their perceptions of the attitudes of the people in the other group–were significantly

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[84]D. Lynn Pulford, "Follow-Up of Study of Science News Accuracy," *Journalism Quarterly* 53 (Spring 1976): 121.

[85]Tankard and Ryan, 334.

[86]Jonathan T. Rich, "A Measure of Comprehensiveness in Newsmagazine Science Coverage," *Journalism Quarterly* 58 (Summer 1981):248-253.

different, the responses generally did not fall at the opposite ends of the scale. In evaluating perceptions of accuracy, Ryan found again that the majority of the responses fell on the same side of an agree/disagree scale. The strongest disagreement occurred in questions dealing with the interpretation of scientific conclusions by writers, the scientists' rights to review material before publication, sensationalism of science news, the need for the scientist to point out the importance of research, and release of data after appearance in scientific journals.[87]

Dunwoody and Ryan administered a mail questionnaire to a group of physical and social scientists to attempt to determine their perceptions of constraints on communicating with the mass media. These constraints were thought to be results of the self-policing scientific culture, specifically, scientists' lack of training for dealing with the media, the scientific reward system, and the peer review system. They found a great deal of variation in responses to any one item with significant numbers on both sides of an agree/disagree scale, "indicating considerable variation in scientists' attitudes about the media and the costs and benefits of interacting with journalists."[88]

Dunwoody and Scott interviewed college faculty members in scientific disciplines to learn more about their interaction with the media. They found that

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[87]Ryan, *op. cit.*, 26.

[88]Sharon Dunwoody and Michael Ryan, "Scientific Barriers to the Popularization of Science via the Mass Media," *Journal of Communication* 35 (Winter 1985): 41.

the group in the study had been in contact with the media more than had been expected and that a scientist's rank within an organizational structure was the most significant predictor of how often he or she had been in contact with the media. A moderate correlation was found between rank and frequency of contact with the evaluation of the quality of coverage of science. Rank was deemed more significant within the scientist's own area, and frequency of contact was more influential in determining the view of other scientific areas. They also found that the scientists preferred to deal with the print media as opposed to broadcast. Magazines were clearly the first choice, and newspapers were second.[89] Suzan DiBella, Anthony F. Ferri, and Allan B. Padderud looked at possible reasons that scientists consent to mass media interviews given the disadvantages often cited. Their conclusion was that university scientists were more likely to cite "seeking to educate the public," private sector scientists were more likely to cite "commercial financial rewards," and government scientists were likely to cite "warning the public."[90]

Scientific periodicals reveal that scientists are concerned with their image in the press. One scientific journal explained: "To give journalists their due, intentional bashing is rare. Misrepresentation generally results from a lack of information or time . . . or a clumsy attempt to simplify complex . . . subjects for

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[89]Dunwoody and Scott, 52-59.

[90]Suzan DiBella, Anthony J. Ferri, and Allan B. Padderud, "Scientists" Reasons for Consenting to Mass Media Interviews: A National Survey," *Journalism Quarterly* 68 (Winter 1991):748.

the lay reader/viewer."[91] The author then explains that this is a difficult task even for the experienced editors. An article in *Fortune* refers to reporters as "strange beasts" and finds peculiar the fact that many journalists "are not highly motivated by money," but the article does advise being honest and straightforward with the media.[92]

CRITICISM OF SCIENTISTS

Criticism of the relationship of scientists and journalists presents numerous paradoxes. There are the reluctant scientists who labor in the laboratory and avoid publicity; there are the unknown scientists whose work may be important but goes unrecognized; and there are the "visible scientists" described by Rae Goodell. These visible scientists "cultivate the press in order to promote a person or policy. This is called 'operating' among reporters, and 'science operators' are among the best in the business."[93] Today's scientists, Nelkin says, are concerned with their "legitimacy in the political arena" and tend to "overestimate the benefit of their work and minimize its risks."[94] The situation often becomes one of either having too much information or none at all so that one of the most difficult chores for

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[91]Suzanne Stock, "Not All Publicity is Good Publicity," *Laboratory Medicine* 22 (August 1991): 526.

[92]Stratford P. Sherman, "Smart Ways to Handle the Press," *Fortune* (19 June 1989): 69-70.

[93]Rae Goodell, *The Visible Scientists* (Boston: Little, Brown and Company, 1977), 177.

[94]Nelkin, 174.

the writer and the editor is selecting from all of the available science stories the ones to present. Universities, pharmaceutical companies, industrial concerns, governmental agencies, and others are using public relations firms to help promote their agendas in the media. The editor, faced with limitations on space, must decide whether to use a story about Alzheimer's disease research or the discovery of a new composite material to use in the manufacture of aircraft.

Cole identified "information control mechanisms" imposed by science groups. These mechanisms attempt to suppress the controversial and to maintain a positive view of scientific work. He explained that the scientific groups and individual scientists may not willingly give out information that is detrimental to their causes. Cole's research showed that newspapers had increased their coverage of controversial science stories during the fifteen to twenty-year period under consideration[95]

These control mechanisms were identified by Dunwoody and Ryan as being fostered by professional and academic societies which "attempt to maintain some control over what constitutes 'proper' behavior for members." In the past, they note, these constraints applied to dissemination of information about their activities. Popularization has been seen as "unethical advertising."[96] Goodell said that the "ethos and aims of science have conflicted with the values and objectives of the press," thereby creating a climate of tension and hostility which inhibits the

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[95]Cole, 466.

[96]Dunwoody and Ryan, 28.

communication of science news. She added that the scientists, "jealous of their right to pursue science in peace and freedom, have resented the intrusion of the press and its threats to the system of technical publication." Reporters, seeing themselves as watchdogs, complain about lack of cooperation.[97]

The "Inglefinger Rule," an editorial policy of the *New England Journal of Medicine* that does not allow publication of articles already released to the public, is often used as an explanation for the reticence of the scientific community. Not only that, scientists feel that publication in their own journals affords the opportunity for peer review and replication of research, thereby lessening the likelihood of fraud and sensationalism. Edward Caudill and Paul Ashdown pointed out the negative result of this practice: the public is sometimes deprived of timely news because of the powerful gatekeeping role of these editors.[98] A story in the *Knoxville News-Sentinel* revealed that the Environmental Protection Agency released new National Aeronautics and Space Administration satellite data regarding the deterioration of the ozone layer before the agency could get it published in a scientific journal. "Such stories have more clout when published officially than when handed out to reporters," explained the article.[99] Prior

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[97]Goodell, 132-133.

[98]Edward Caudill and Paul Ashdown, "The New England Journal of Medicine as News Source," *Journalism Quarterly* 66 (Summer 1989): 459.

[99] *Knoxville News-Sentinel*, "Opinion," April 7, 1991, F3.

publication, review by peers, and replication of research lends more credibility to a story.

Often the scientific community cites the need for peer review as the reason for publishing in scientific journals before going public with discoveries. Charles W. McCutchen charged, however, that peer review is out of control, that the system is fraught with fraud and politics, and that the modern scientists must "sing for their supper" to obtain the approval of the powerful peer reviewers who "wield over them the power of professional life and death."[100] He advocated changes to the system to tame the power of these reviewers.

Adding to the difficulty of any endeavor to communicate science is the fact that the writer must sort out ideas and concepts that are "less than clear even to many scientists."[101] Scientists generally admit that their writing could stand improvement, and they often mention this difficulty in their essays on problems in creating interest in science. N. David Mermin stated that "when we write physics or about physics as badly as we often now do, we undermine our science."[102] Goodfield presented an interesting counter to the plea of the scientific community for more communication with the public: "We have scientists uttering pious platitudes about public communication and the need for public understanding of

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[100]Charles W. McCutchen, "Peer Review: Treacherous Servant, Disastrous Master," *Technology Review,* (October 1991): 29.

[101]Burkett, 4.

[102]N. David Mermin, *Boojums All the Way Through: Communicating Science in a Prosaic Age*, (Cambridge: Cambridge University Press, 1990), *xii.*

their work and its processes, and of their humanity, while continuing to maintain hypocritical attitudes which may well act to prevent the very thing they are asking for."[103] She explains that the scientists operate under two constraints. First is the nature of science itself in which the investigation of the unknown is a "chancy business," and the second is an ambivalence about going public at all.

Adding to the difficulty for the journalist is dissension and polarity in the scientific culture. Scientists do not speak as one. R. Gordon Shepherd said that the scientific community is often divided as to the practical meaning of its discoveries or how these findings should be used. "Thus," he noted, "many social controversies are characterized by scientific advocacy on opposing sides of an issue."[104] The press is often accused of feeding on this pluralism. The problem of global warming is one such issue. There is not total agreement in the scientific community. Other examples of advocacy on both sides of an issue are the use of estrogen replacement therapy in post-menopausal women and whether or not nearby electro-magnetic fields are harmful.

THE SCIENCE CRITIC

Another aspect of the climate of two cultures is the notion of the science critic–that is, the journalist as science critic. Nelkin suggested that the *Challenger*

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[103]Goodfield, 34.

[104]R. Gordon Shepherd, "Selectivity of Sources: Reporting the Marijuana Controversy," *Journal of Communication* 31 (Spring 1981): 131.

accident "more than any other event brought press and public awareness of the importance of probing and critical science journalism."[105]

Some in the scientific community have called for a new breed, a science critic who goes beyond the mere reporting of science. Goodfield envisions "a new group of people, outside the scientific profession yet looking at it critically."[106] Goldsmith refers to this new type of communicator, who is to apprise the scientific community of the public's response to scientific enterprise, as a "poet and a visionary . . . who is to see the whole picture . . . and communicate science, so that people understand its poetry and cease to have fear of it."[107]

Of course, criticism of science poses risks for the journalist. As Bennett pointed out, journalists place scientists on the defensive when they "write critically about scientists as entrepreneurs . . . or when they question the conduct of science or the social value of a research effort."[108] Although a number of scientists view the press as a pipeline for communicating science to the public in a way that the public can understand, these scientists expect to control this flow. Nelkin said, "They are reluctant to tolerate independent analysis of the limits or flaws of science."[109]

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[105]Nelkin, 172.

[106]Goodfield, 95.

[107]Goldsmith, 83.

[108]Bennett, 126.

[109]Nelkin, 179.

In today's environment, where scientists and researchers are in competition for a share of research funds provided by the federal government, the science journalist risks being used to promote the advantage of the agency, university, foundation, institution, or whatever. LaFollette noted, "The newest challenge . . . is how to be vigilant critics of those aspects of science in which there is some inherent and vital public interest . . . which stands to benefit from significant government and private investment, yet where no scientific consensus exists."[110] In referring to the reporting of medical news, Caudill and Ashdown concluded that editors must "be familiar with the context of medical research and be sensitive to the presence of special interest groups competing for a voice in the direction of the medical profession."[111]

Some journalists are beginning to question their role as mere conduits of information from the world of science, rewriting and passing on what is told to them. Nelkin described these journalists as breaking away from the tendency to see scientists as objects of awe because of their education and knowledge and are becoming wise to the "promotional hype about science . . . are reacting to certain events such as Three Mile Island and the *Challenger* explosion and are asking probing questions: Who pays? Who is responsible? What's in it for the public? What are the stakes?"[112]

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[110]LaFollette, 15.

[111]Caudill and Ashdown, 462.

[112]Nelkin, 180.

Communication of science and technology is thought by many to be extremely important; and, certainly, the news media play a critical role in bringing such information to the public. The reasons for desiring a science-literate populace are many. Both monetary and political support are crucial to the continuation of much research. Scientists desire to spark interest in science among the youth who will provide the pool of theorists and inventors for the future. Knowledge of what is going on in science has great societal benefits when societal action results. Surely the collective cholesterol of Americans has been lowered by their exposure to health information. Surely landfills are filling up a little more slowly as concerned citizens have come to appreciate the environmental necessity of recycling waste.

METHODOLOGY

The East Tennessee Resource Valley is now served by one major local newspaper, the morning paper is the *Knoxville News-Sentinel* (daily circulation: 103,886; Sunday circulation: 174,860).[113] At the time of this study the *Knoxville Journal* (circulation: 42,046), the afternoon paper, had ceased publication as a daily and had become a weekend-only periodical at the beginning of 1992. The newspaper in Oak Ridge, the *Oak Ridger* (circulation 10,952)[114] is published six

[113]These are the Audit Bureau of Circulation figures for September 1991 and were provided over the telephone by Linda Webb of the *Knoxville News-Sentinel.*

[114]*Editor and Publisher Yearbook 1989* (New York: Editor and Publisher, 1989), I-308, I-310-311.

days a week. Several weekly papers are published in small towns in the area, but these are not a part of this study.

THE SUBJECTS

The subjects were chosen in a systematic random sample of scientists and engineers listed in a computer data base maintained by the Oak Ridge National Laboratory (ORNL) and engineers listed in a data base maintained by the Engineering Division of Martin Marietta Energy Systems. A total of 800 were selected, 400 from each data base. The ORNL data base, known as the "technical directory," lists employees according to academic majors. The academic majors most nearly fitting two of the three categories of scientists (social science was not used in this sample) identified by Dunwoody and Scott were chosen from this data base to provide the population from the sample was selected. The Engineering Management Information System (EMIS) data base lists employees of the Engineering Division according to their job categories. This data base provided the names of those people classified as engineers.

The population from which the samples were drawn did not include all of the scientists and engineers employed within the company, only those listed in the aforementioned data bases. It was not possible to obtain access to all employees with degrees in physical, life, or applied sciences. A further limitation was imposed by the fact that not all of the people listed as engineers actually have degrees in

an engineering discipline. "Engineer" is a job category, and those so classified may have backgrounds in other fields.

A pre-test of the general subject matter, but not the precise questions, was given to approximately 35 engineers and scientists in a four-state area in the spring of 1991. This survey substantiated the view that scientists and engineers were interested in the research question and understood the general line of questioning.

At the beginning of January, a three-page questionnaire was delivered through the in-plant mail system to the combined sample of 800 scientists and engineers. The rationale for selecting this date was to avoid the holidays and vacations that might have affected a mailing during December. The advantage of using this method was the avoidance of the high cost of postage.

A total of 470 responded (five arrived past the cut-off date), thereby resulting in a response rate of 58.75 percent. There were 212 responses from the technical directory. That is 53 percent. There were 258 responses from the EMIS data base of engineers for a 64.5 percent response. Seven additional people returned their questionnaires with an indication that they did not choose to participate. If these are included, the rate of return is 59.6 percent.

The mailing included a numerically coded return envelope that traced respondents to the technical directory or to the EMIS data base so that comparisons could be made of the response rates. Responses were not correlated to the names of the respondents, thereby assuring complete confidentiality. A

cover letter explained the purpose of the research and identified the researcher and the affiliation with the company and with the University of Tennessee. Because the response rate was deemed acceptable, a second mailing or reminder was not necessary. A further reason for not sending out additional mailings or prodding respondents with telephone calls was the fact that these people are engaged in important work for the company under contract to the Department of Energy and are extremely busy. To take up more of their time or to use additional company resources might have incurred the wrath of management, which has been extremely cooperative in this effort.

THE QUESTIONS

The questions were to accomplish the following: (1) determine the scientists' and engineers' readership of local newspapers; (2) obtain opinions about the amount of science news in these papers and the quality of that news; (3) discover attitudes about some of the more frequently voiced criticisms of science news coverage in newspapers; (4) find the degree of interaction with newspaper reporters; (5) learn something of the demographics of the subjects selected; (6) give the scientists the opportunity to speak out about the relationship of scientists and the media; and (7) give the scientists a forum for offering suggestions, and (8) learn some of the most often-cited sources of science news for this sample.

The instrument used a variety of types of questions to obtain data: (1) open-ended; (2) a seven-point Likert scale; (3) multiple choice (4) rankings. The

topics of the questions were inspired by a variety of studies and reviews. One source was a panel discussion during the 1982 Annual Meeting of the American Association for the Advancement of Science (AAAS).[115] The members of the panel were all science writers and perhaps more wise to the ways of the media than the average working scientist. Another inspiration for questions came from the Dunwoody and Scott study of scientists in academe. The questionnaire is in Appendix A.

The Tankard and Ryan study of the perception of accuracy in science news stories provided the components of two of the questions: (1) Differing opinions among scientists and reporters about the importance given to information in a story; that is, the omission of crucial information to the understanding of research results; and (2) misleading headlines for science stories. Their sample of 193 scientists indicated 76.3 percent agreed that scientists and reporters would have differing opinions on what information was important to a story, and 82.4 percent said that headlines for science stories were often misleading.[116]

Dunwoody and Scott tested several hypotheses concerning the relationship of scientists and journalists. Some of these were adapted as research questions for this investigation: (1) The more frequent the contact between a scientist and journalists, the more favorably the scientist would evaluate mass media dissemination of science. Dunwoody and Scott found a correlation between

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[115]Dunwoody, Friedman, and Rogers, 104.

[116]Tankard, p. 223

contact and evaluation of coverage outside the scientists' own areas of expertise.[117] Scientists and engineers in the present study were asked to indicate contact with journalists and to characterize that contact. (2) The higher the scientist's academic rank, the more favorably he or she would evaluate media coverage of science. This hypothesis was supported by Dunwoody and Scott's research and was studied in the Oak Ridge sample by cross-tabulation between level of education and attitude toward science coverage. (3) Scientists will have a more favorable view of the presentation of science news outside their field. This was substantiated by Dunwoody and Scott. Similar questions were used in the Oak Ridge study to elicit responses for science news within the scientists' own fields and in other scientific fields.

The AAAS panel discussion considered the question of "accuracy" and what it means to scientists and to journalists. Their conclusion that the term is "value-laden" led to two of the statements in the Likert-scale portion of the questionnaire used for the present study. One sentence states that "'accuracy' does not mean the same thing to a reporter that it does to a scientist," and the other states "scientists and reporters are likely to disagree about the importance given to information in a story."

[117]Dunwoody and Scott, p. 56.

The suggestion that scientists be allowed to check a story before publication has been discussed throughout the years.[118] This topic was again brought out by the AAAS panel and is covered in one of the scale questions. The AAAS panel also discussed the argument that news media give too much attention to extremists in an attempt to balance a story. This study examines this contention in one of the scale questions. The belief that headlines tend to be misleading was studied by Tankard and Ryan, among others.

The suggestion that the news media should be more critical of science by asking such questions as "What are the stakes?" Who pays?" was inspired by Nelkin. When queried about these suggestions, Nelkin explained that the statements were not meant to be construed as anti-science.

The questionnaires were assigned a three-digit case identification number in sequence as they were tabulated. The tabulation consisted of numerically coding the responses to the questions so that the data could be manipulated by the computer program. For example, "yes" responses were coded as "1." A "no" was coded as "0."

The open-ended questions were placed into categories, based on analysis of the responses. For example, when asked to list positive aspects of the press, a number of respondents answered, "informs," or something to that effect. Because "heightens awareness" might be somewhat different from "informs," it was coded

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[118]James W. Tankard, Jr. and Michael Ryan, "The Right of Review: Error Check or Censorship?" *The Quill* 61:20-2 (May 1973).

as a separate response. The same is true for "educates," which is somewhat different, perhaps, than "informs." The answers were coded and placed in a WordPerfect file for eventual uploading to SPSS-X, where the cross tabulations and summaries were made.

PROBLEMS

One unforeseen circumstance at the time this project was begun was the ultimate demise of the Knoxville *Journal*. The last day of publication as a daily occurred six days before the questionnaires were mailed. The impact of this on the study is ameliorated, however, by the fact that only 39 respondents indicated that they read this paper. Further, a note was inserted on the questionnaire requesting that this paper be considered prior to its cessation.

On some of the questionnaires, the category of "life science" was inadvertently omitted from the demographic question dealing with occupation. In the correct version, life sciences were lumped with physical sciences. Only a few respondents appeared to have trouble with this categorization, and they wrote notes expressing their displeasure with the categories. This made it possible to place them in the correct spot. A few also wrote "life science" in the "other" category so that their correct occupational category was easily determined. This had no effect on the ultimate outcome.

CHAPTER 3

Thou shalt not answer questionnaires
Or quizzes upon world affairs
Nor with compliance
Take any test. Thou shalt not sit
With statisticians nor commit
A social science.
-- W. H. Auden in "A Reactionary for the Times"

RESULTS

READERSHIP

The scientists and engineers in the survey have a choice of three local newspapers in addition to those from out-of-town. The responses indicated that 66.9 percent of those answering the questionnaire said that they read the *Knoxville News-Sentinel*. The *Oak Ridger* was second with 28.4 percent. Thirteen percent, selected "other" and named such newspapers as the *Washington Post*, *New York Times*, *Wall Street Journal*, *Roane County News*, and *Chattanooga Free-Press*. The *Knoxville Journal* with 39 readers, 8.4 percent of the total, was last. These percentages add up to more than 100 because some people indicated that they read more than one newspaper.

In a time when newspaper readership is said to be declining, it is reasonable to attempt to ascertain how often the participants in the survey read the paper. Seventy percent read the paper more than five days a week; and the

remaining 30 percent read the paper less than four days a week, including the 11 respondents who indicated they never read the paper.

It had been expected that the scientists and engineers in the survey would call for more science news in newspapers, but only slightly more than one-half indicated a belief that there was not enough science news in the paper that they read. Thirty-seven percent said there was about the right amount. When the data were examined by each newspaper, 60 percent of the *News-Sentinel* readers thought there was not enough science news in that paper, and 29 percent thought that it had about the right amount. Thirty percent of the *Oak Ridger* readers indicated there was not enough science news, and 62 percent said there was about the right amount. See Table 1.[119]

These findings may be explained by a later question which asked the respondents to rank the sources of their science news. Clearly, newspapers were not a major source of science news for the scientists and engineers. This may have affected their attitudes toward the quantity of science news because newspapers are not viewed as a major medium for dispensing science news.

SCALE QUESTIONS

The response categories to the seven-part Likert scale used for the attitudinal questions were given numerical weights to facilitate analysis of the general direction of the responses either favorable or unfavorable. Thus, "strong

[119]All tables may be found in Appendix B.

agreement" was assigned the value of one and progressed to "strong disagreement" which was assigned the value of seven. These scores were averaged. Further analysis was provided by collapsing the responses into four categories in order to run cross-tabulations with demographic data and other responses. The four resulting categories were "no answer," "agree," "neutral," and "disagree."

Scientist's Own Field

The first scale question states: "Newspapers do a good job of reporting scientific endeavors in my field." If these responses are dichotomized into "agree" and "disagree," 55.5 percent fall into the disagree category and 25.1 percent into the agree category. (The missing and neutral were ignored.) The average for the weighted tally was 5.58 with seven being strong disagreement. All of these data tend to support the view that scientists do not feel that the news media do a very good job of reporting science in their own fields.

Other Fields

The next scale question sought to determine whether or not the scientists would evaluate more favorably the job done by newspapers in other scientific disciplines. When the responses are separated into "agree" and "disagree" categories, it becomes obvious that nearly one-half of the respondents disagree with the statement that newspapers do a good job of reporting science in other fields (47.3 percent disagree; 29.3 percent agree). This can be compared to the previous question, "Newspapers do a good job of reporting scientific endeavors in

my field," in which 25.1 percent agreed and 55.5 percent disagreed. The weighted average for this question yields 4.70, slightly toward the disagreement side of neutral. This lends some support to the supposition that scientists would rate more favorably the reporting of science news in other fields than in their own, but still they maintain a generally negative view of newspapers' presentation of science news.

Perception of Accuracy

The scientists and engineers responding to the survey almost overwhelmingly agreed with the statement that accuracy does not mean the same thing to a newspaper reporter that it does to a scientist. The weighted average for this statement is 1.98 with "1" being strongly agree. Dichotomizing the agree and disagree portions of the scale reveals that 418 of 467 respondents (89.7 percent) agree with the statement. Only 13 disagreed, and 30 were neutral. These data lend support to the idea that scientists do not believe that accuracy means the same thing to a newspaper reporter that it does to a scientist.

Emphasis to "Extremists"

The statement that newspapers give too much emphasis to "extremists" in order to present both sides of a story elicited a high percentage of agreement by the respondents (76.7 percent) when the categories were dichotomized although some indicated that they did not think the reason could be attributed to a desire to present both sides of a story. Three percent disagreed. The weighted average

for this question was 2.5, which lies between agree and mildly agree. These data lend support to the idea that scientists believe that newspapers give too much emphasis to extremists in order to present both sides of a story.

Importance of Information

Another statement garnering a relatively high percentage of agreement said, "Scientists and reporters are likely to disagree about the importance given to information in a story." The weighted average for this question was 2.22, very close to "agree" scored at 2. Dichotomizing the responses into agree and disagree categories results in 88.1 percent agreement and a mere 3 percent disagreement. The other respondents were neutral or did not answer.

These data lend credence to the idea that scientists believe that scientists and reporters are likely to disagree about the importance given to information in a story.

Communication with Public

The statement, "The press is valuable in helping scientists communicate with the public," produced generally positive responses. The weighted average was 2.9, very close to the score of "3" given to mildly agree. When the answers were dichotomized into agree and disagree categories, 71 percent fell into the agree category and 17.9 percent into the disagree category. These data tend to support the view that scientists believe the press to be valuable in helping scientists communicate with the public.

Lot to Lose

The statement, "Scientists have a lot to lose if they deal with the press," drew agreement from 30.4 percent of the respondents when the response scale was dichotomized into agree and disagree. Conversely, 41.6 percent disagreed. The neutral category accounted for 27.5 percent. The weighted average for this question was slightly favorable to the press; that is, the score of 4.2 shows something between neutrality and mild disagreement. One can surmise that those who felt that scientists had a lot to lose in dealing with the press were speaking from the standpoint of the bureaucracy in which they work, where speaking openly with the press is not always seen as a prudent thing to do. Overall, however, these data lend some support to the belief that scientists would disagree with the statement.

Check the Story

The statement that a reporter should allow the scientist to check the story for inaccuracies before publication drew great agreement. When the tabulations were placed into three categories of "agree," "disagree," and "neutral," the scores were follows: 92 percent agreed; 2.6 percent disagreed; 4.5 percent were neutral. The weighted average was 1.8 (strongly agree was scored as 1) for this statement.

Misleading Headlines

The statement, "Headlines for science stories are often misleading," produced general agreement. The data support the idea that scientists would

agree with the statement. If the three "agree" categories are combined, they account for 83.5 percent of the responses. Table 46 depicts the overall frequencies and responses. The weighted average for the responses is 2.3 which is between "agree" and "mildly agree."

Be More Critical

The suggestion that newspapers should be more critical of science produced more neutral responses (29.7 percent) than either agree or disagree. However, by dichotomizing the three agree categories and the three disagree categories, the implication is that the respondents would agree that the newspapers should be more critical of science. The three agree categories total 51.5 percent, and the disagree categories total 17 percent. Assigning weights to the scores for this question produces an average of 3.01, indicating mild agreement. It is not possible to draw any real conclusions from these differences. These data lend mild support to the view that scientists would agree that newspapers should be more critical of science.

Disrespectful

Approximately one-half of the respondents were neutral (53.5 percent) when asked to rate their opinions on the statement: "Reporters are too disrespectful of scientists." Adding together the three disagree categories produced 27.6 percent, while adding the three agree categories together produced

17.6 percent. Weighted responses resulted in an average of 4.16, very near the score of 4 for neutrality.

Fairness

A little over one-third (36.9 percent) of the respondents felt that reporters are generally fair to science while slightly fewer (34.4 percent) were neutral. The weighted average for this statement was 3.90, very close to neutral.

QUALITY OF LOCAL SCIENCE NEWS

The quality of science news in the three local papers was the subject of a question that allowed respondents to make one choice ranging from excellent to poor or no opinion. The *News-Sentinel* was rated fair or good by 54.6 percent; poor by 30 percent; and no opinion by 10 percent. The *Oak Ridger* received excellent marks by 14 readers, but nevertheless only 43.6 percent of the respondents deemed this paper "fair" to "excellent." The preponderance of respondents (37.4 percent or 174) who attempted to judge the *Journal* said that they had no opinion.

DEMOGRAPHIC VARIABLES

The variables with which attitudes and perceptions of newspaper coverage of science were cross-tabulated included occupation, education, age, and frequency of newspaper readership.

Occupation

Cross-tabulation between agreement about the job in the scientists' own fields and the occupations of the respondents shows the physical and life scientists and the applied scientists to be relatively close in their views. Fifty-nine percent of the physical and life scientists disagreed with the statement that newspapers did a good job in their own fields, and 54 percent of the applied scientists disagreed. These data were highly statistically significant ($p < .01$). See Table 2.

The cross-tabulation of occupation with the statement that newspapers do a good job of reporting science news outside the respondents' own fields indicates that one-half of the physical and life scientists do not think that newspapers do a good job of reporting science news outside their fields. Slightly more (25 percent) said they were neutral than said they agreed (23 percent). There was more agreement with the statement from the applied scientists (33 percent) versus disagreement (45 percent). These data are highly statistically significant ($p < .01$). See Table 3.

By occupation, 88 percent of the physical and life scientists and 90 percent of the applied scientists agreed with the statement that accuracy does not mean the same thing to newspaper reporters that it does to scientists. These data were statistically significant ($p < .05$). See Table 4.

The occupational categories were close in their agreement with the statement that newspapers sometimes give too much space to extremists in order to present both sides of a story. Seventy-five percent of physical and life scientists

agreed, as did 77 percent of the applied scientists. These data, however, were not statistically significant ($p > .10$). See Table 5.

When occupation was cross-tabulated with the statement that scientists and reporters might disagree over the importance of information in a story, 90 percent of the applied scientists concurred, as did 85 percent of the physical and life scientists. These data were highly statistically significant ($p < .01$). See Table 6.

Cross-tabulation of occupation with the statement that newspapers help scientists communicate with the public shows that 73 percent of the applied scientists agree, as did 67 percent of the physical and life scientists. These data are highly statistically significant ($p < .01$). See Table 7.

When comparisons are made between the physical and life scientists and the applied scientists on the statement that scientists have a lot to lose if they deal with the press, 52 percent of the physical scientists disagree and 25 percent agree. For the applied scientists 37 percent disagree, and 31 percent agree. This appears to indicate that engineers are more likely to think that a scientist or engineer has a lot to lose in talking to the press than do the scientists. These data indicate high statistical significance ($p < .01$). See Table 8.

The statement that a reporter should allow the scientist to check a story for inaccuracies before publication elicited tremendous agreement from the respondents when cross-tabulated with occupation. There was 94 percent agreement for physical and life scientists and 91 percent agreement for applied

scientists. Only two percent of the physical scientists disagreed, as did only three percent of the applied scientists. These data were statistically significant ($p < .10$).

The statement that headlines for science stories are often misleading was endorsed by 83 percent of the physical and life scientists and 84 percent of the applied scientists. These data were statistically significant ($p < .05$). See Table 9.

A little more than 50 percent of the respondents agreed with the suggestion that the press should be more critical of science by asking such questions as what are the stakes and who pays. Cross-tabulation of the statement and occupation reveals agreement by 53.5 percent of the physical and life scientists and by 49.5 percent of the applied scientists. These data were highly statistically significant ($p < .01$). See Table 10.

While one-half of the respondents were neutral on the statement that reporters are too disrespectful of scientists, cross-tabulation of the remainder for occupation and agreement with the statement revealed stronger agreement among the applied scientists (20.5 percent) than among the physical and life scientists (12 percent). Conversely, more of the physical and life scientists disagreed with the statement (21 percent) than did the applied scientists (15.2 percent). These data were highly statistically significant ($p < .01$). See Table 11.

When the scale statement, "Reporters are generally fair to science," was cross-tabulated with occupation, more physical and life scientists were neutral (40.5 percent) than applied scientists (31.3 percent). Thirty-six percent of the physical scientists agreed with the statement as did nearly 38 percent of the

applied scientists. These data were highly statistically significant ($p < .01$). See Table 12.

Education

Cross-tabulation of education with attitude toward the amount of science news revealed that 71 percent of those in the post-bachelors group thought there was not enough science news, but this feeling was shared by only 43 percent of the postdoctoral respondents. Other categories and percentages saying there was not enough science news were: high school, 33 percent; bachelors' degrees, 47 percent; masters degrees, 50 percent; past the masters, 60 percent; and doctoral, 44.5 percent.

When education was cross-tabulated with the statement about the presentation of science news in the scientists' own fields, the range was from 43 percent disagreement for those with bachelors' degrees to 61 percent for those who had postdoctoral study and 58 percent for those with doctoral degrees. Conversely, 31 percent of the people with bachelors' degrees agreed with the statement, and 22 and 23 percent of the doctoral and postdoctoral graduates agreed. The category "BS/BA plus" scored closer to the doctoral group -- 64 percent disagreement and 21 percent agreement. These data were not statistically significant ($p > .10$). See Table 13.

Cross-tabulation of education with "good job of reporting science outside my field" indicates that those with more than a bachelor's degree are more likely

to disagree than those with the bachelors degree. The bachelors degree category expressed 37 percent disagreement, while the remaining levels of education were closely aligned (ranging from 47 percent to 51 percent). These data were not statistically significant ($p > .10$). See Table 14.

The belief that accuracy does not mean the same thing to a reporter that it does to a scientist was cross-tabulated with the levels of education for the respondents. Overall, 90 percent of the respondents agreed with the statement. The percentages for the educational categories held close to that figure. However, these data are not statistically significant ($p > .10$). See Table 15.

The statement that newspapers give too much emphasis to extremists in order to present both sides of the story was cross-tabulated with educational levels. Agreement was high in all educational categories. These data were not statistically significant ($p > .10$). See Table 16.

Responses to the scale question of whether or not scientists and reporters are likely to disagree over the importance given to information in a story were cross-tabulated with education. Results indicated a low of 80 percent agreement for the postdoctoral group and a high of 100 percent for high school graduates. The next highest category of agreement with the statement was in the post-masters degree group. These data are not statistically significant ($p > .10$). See Table 17.

Percentages resulting from the cross-tabulation of education and agreement with the statement that the press is valuable in helping scientists communicate

with the public parallel the amount of education. The greater the amount of education, the less likely that the respondent will agree that the press is valuable in helping scientists communicate with the public. The range is from 77 percent agreement for the BS and BA group to 69 percent for those in the postdoctoral category. These data are not statistically significant ($p > .10$). See Table 18.

One of the scale questions stated: "Scientists have a lot to lose if they deal with the press." Disagreement with this statement increases with education beginning in the 30 percent range for those with less education and increasing to 64 percent disagreement for those with postdoctoral degrees. These data are statistically significant ($p < .05$). See Table 19.

Cross-tabulation of the statement that scientists should be allowed to check a story for inaccuracies before publication with level of education indicates that the lowest level of agreement (88 percent) was in the category for the postdoctoral respondents. These data are not statistically significant ($p > .10$).

The statement that headlines are frequently misleading was cross-tabulated with education. Although agreement with this proposition was high across all levels of education, these data were not statistically significant ($p > .10$). See Table 20.

Cross-tabulation of the recommendation that the press should be more critical of science with level of education shows agreement by approximately one-half of the respondents. These data are not statistically significant ($p > .10$). See Table 21.

with level of education from percentages in the teens at the lower levels to 36 and 37 percent for the doctoral levels. These data were not statistically significant ($p > .10$). See Table 22.

The level of education was not statistically significant ($p > .10$) when cross-tabulated with the statement: "Reporters are generally fair to science." Thirty-nine percent of the doctoral and 47 percent of the postdoctoral respondents agreed, but disagreement was also in the range of 34 to 39 percent for these two groups. See Table 23.

Age

When age was compared with the attitude toward the amount of science news in the newspapers, approximately 50 percent in each age group said there was not enough science news and from 26 to 39 percent said the amount was about right. There was, however, one exception. The respondents over the age of 60 were the reverse of the other groups; that is, 39 percent said there was not enough and 52 percent said that there was about the right amount.

The cross-tabulation of age and the scale question, "Newspapers do a good job of reporting scientific endeavors in my field," was statistically significant ($p < .05$). The highest percentage of those disagreeing with the statement were in the 40 to 49 age group. The younger respondents, ages 20 to 29, were more likely to agree (41 percent). See Table 24.

The cross-tabulation of age and the scale question, "Newspapers do a good job of reporting scientific endeavors outside my field," was not statistically significant ($p > .10$). The highest percentage of those agreeing with the statement were in the 20 to 29 age group (41 percent). Greatest disagreement was among the two groups of respondents between 30 and 49 (50 and 54 percent). See Table 25.

The statement, "'Accuracy' does not mean the same thing to a reporter that it does to a scientist" garnered a high percentage of agreement. However, cross-tabulation indicates the data are not statistically significant ($p > .10$). See Table 26.

Cross-tabulation of age with the statement that newspapers give too much emphasis to extremists was not statistically significant ($p > .10$). Agreement with the statement appears to increase with age; that is, agreement begins at 68 percent in the 20-29 category and progresses to 79 percent for those over 60. See Table 27.

When age was considered with the statement that scientists and reporters are likely to disagree over the importance given to information in a story, the resulting cross-tabulations were not statistically significant ($p > .10$). There were high percentages of agreement across all of the age categories. See Table 28.

The scale question, "The press is valuable in helping scientists communicate with the public," garnered more than 60 percent agreement for all age categories. These data were not statistically significant ($p > .10$). Interestingly, stronger agreement was noted among the younger respondents. See Table 29.

When the statement, "Scientists have a lot to lose if they deal with the press," was cross-tabulated with age, the results were not statistically significant ($p > .10$). The respondents over the age of 60 exhibited 43-percent agreement, while agreement among the younger respondents was in the 20-percent range. See Table 30.

The cross-tabulation of age and the statement that headlines are often misleading indicated that most respondents fell into the agree category. However, these data are not statistically significant ($p > .10$). See Table 31.

The scale question dealing with the need for the press to be more critical of science was cross-tabulated with age. The results show that the percentages of those disagreeing tend to decrease with the age of the respondent. For example, 31.7 percent of the 20- to 29-year old scientists and engineers disagree, while only 11.1 percent of those over 60 disagree. But also, 51.2 percent of those between 20 and 29 agree and 48.1 percent of those over 60 agree. These data are statistically significant ($p < .05$). See Table 32.

Cross-tabulation of age with the statement that reporters are too disrespectful of scientists did not yield statistically significant results ($p > .10$). The respondents were relatively neutral, ranging from 66 percent neutrality for the 20-to-29 age group to 46.3 percent for those over 60. See Table 33.

Cross-tabulation of age and the scale question dealing with reporters' fairness to science indicate stronger opinions both negative and positive for the

Cross-tabulation of age and the scale question dealing with reporters' fairness to science indicate stronger opinions both negative and positive for the postdoctoral respondents. These tabulations are not statistically significant ($p > .10$). See Table 34.

Frequency of Readership

The cross-tabulation of the scale question, "Newspapers do a good job of reporting scientific endeavors in my field," with frequency of readership was not statistically significant ($p > .10$). The resulting table shows, however, that readership and the statements of agreement and disagreement are relatively similar throughout the readership frequencies. See Table 35.

Similarly, cross-tabulation of the scale question, "Newspapers do a good job of reporting science outside my field," was not statistically significant (p .10). Agreement was low regardless of the frequency of readership. See Table 36.

Frequency of readership cross-tabulated with the statement, "'Accuracy' does not mean the same thing to a reporter that it does to a scientist," was not statistically significant ($p > .10$). Again, there were high levels of agreement with the statement regardless of the age of the respondent. See Table 37.

Cross-tabulation of frequency of readership and the statement alleging that newspapers give too much emphasis to extremists showed high levels of agreement throughout the age categories. These results, however, were not statistically significant ($p > .10$). See Table 38.

information in a story, these results were not statistically significant ($p > .10$) when cross-tabulated with frequency of readership. See Table 39.

Frequency of readership cross-tabulated by the statement that the press is valuable in helping scientists communicate with the public was not statistically significant ($p > .10$). Agreement with the statement was high throughout the frequencies of readership. See Table 40.

Cross-tabulation of frequency of readership and the scale statement that scientists have a lot to lose if they deal with the press did not produce any discernible patterns. Overall, there was mild disagreement with the statement. These data were not statistically significant ($p > .10$). See Table 41.

The only statistically significant ($p < .05$) cross-tabulation with frequency of readership occurred with the statement that headlines for science stories are often misleading. There were high levels of agreement across the ranges of readership frequencies. See Table 42.

Cross-tabulation of frequency of readership with the scale statement that the press should be more critical of science did not indicate discernible patterns among the readership categories. These data were not statistically significant ($p > .10$). See Table 43.

Frequency of readership cross-tabulated with the statement that reporters are too disrespectful of scientists was not statistically significant ($p > .10$). However, it can be seen that the responses were fairly evenly distributed throughout the categories. See Table 44.

Frequency of readership cross-tabulated with the statement that reporters are generally fair to science was not statistically significant ($p > .10$). However, it can be seen here, as it was in the previous table, that the responses were fairly evenly distributed throughout the categories. See Table 45.

SOURCES OF SCIENCE NEWS

Two questions sought to ascertain the main sources of science news for scientists in their own field and in other fields. The respondents were asked to rank the possibilities in order using "1" for the most-used source and "0" as an indication that the source was rarely, if ever, used. Because a number of respondents chose to answer with binary digits – that is, using only one's and zero's (as a computer would do) or blank spaces and check marks – it is not possible to derive a valid ranking from the data collected. Evidently, this resulted from a problem in the statement of the questions in the questionnaire. Analysis of the answers, however, reveals that peers and scientific journals are the major sources of science news. Newspapers were not ranked very high.

When asked to name specific sources of science news, the respondents collectively have provided a list of numerous journals in their fields -- such journals as *Physics Today*, *Chemical Progress*, *Engineering News Record*, and *Nuclear News*. The scientists and engineers also listed a number of magazines with broader appeal. Among these were *Nature, Scientific American, Science, Sky and*

Telescope, and the weekly news magazines, *Time* and *Newsweek*. See Appendix D for a listing of the periodicals named by the respondents.

CONTACT WITH NEWSPAPER REPORTERS

When queried about having been contacted by newspapers concerning their scientific work, 28.4 percent (132 respondents) replied that they had dealt with the news media. Of this number, 78 were physical and life scientists, 47 were applied scientists, and seven were from the "other" category. Within the groupings, 49.5 percent of the physical and life scientists had been contacted by a newspaper about their scientific work while only 15.8 percent of the applied scientists had been contacted by a reporter. This can probably be explained by the nature of the work done by the two groups. Generally, the work that many engineers and applied scientists do is not deemed quite as newsworthy.

The next question attempted to quantify the exposure to newspaper reporters by asking the number of times the scientists had been contacted by the media about their work. For purposes of computer analysis, these responses were grouped into five categories: (1) one or two; (2) three or four; (3) five or six; (4) seven or eight; (5) more than nine. The results show that 59 (12.8 percent) had been contacted one or two times; 23 (0.5 percent) three to four times; 18 (3.9 percent) five to six times; 4 (0.9 percent) seven to eight times; and 23 (0.5 percent) more than nine times.

Cross-tabulation of opinion of experience with newspaper reporters with the occupational categories indicates that the applied scientists and the physical and life scientists are closely aligned in evaluating their experiences with the media. Fifty-seven percent of the physical scientists and 56 percent of the applied scientists rated the experience as "average." These results were highly statistically significant ($p < .01$). See Table 46.

Cross-tabulation of the opinion of the experiences with the newspaper reporters with the amount of education attained by the respondents showed the preponderance of respondents ranking the experience as "average." The greatest number of respondents rated the experience as average for each level of education except those in the category with a masters degree plus extra collegiate work. Of the 113 respondents who had been contacted by the media, seven classified the experience as "extremely poor," and 24 classified it as "very good." These findings were highly statistically significant ($p < .01$). See Table 47.

Cross-tabulation of opinion of contact with the media and age of the respondents indicates that most of the respondents deemed the experience "average." The greatest percentage (77) rating the experience as average were between 30- and 39-years-old. The greatest percentage (35.2) rating the experience as very good were more than 60. These results were statistically significant ($p < .05$). See Table 48.

POSITIVE ASPECTS

The answers to the open-ended question "Please list any positive aspects that you have observed in press coverage of science" fell into 46 categories. The most frequently mentioned positive aspect was that the press informs; this was cited by 59 of the respondents who chose to write an answer to this question. The second most frequently named positive aspect was that the press heightens the awareness of the public about science. This was listed by 40 respondents.

Some of the other most often mentioned positive aspects and the number of citations were as follows: good interpretation of science for the layman to understand, 29; tries to do a good job, 20; good coverage of breakthroughs and innovations, 18; the fact that newspapers cover science at all is a plus, 18; and good coverage of environmental issues, 14. Appendix C contains the remaining responses to this questions with the number of times each was mentioned.

NEGATIVE ASPECTS

When asked to list negative aspects of newspaper coverage of science, the following categories of answers were given. Note that some negatives were also listed as positives, showing a certain amount of disagreement among the respondents about what is good and bad about the way the press handles science. The top-ranking responses were: sensationalizes, 81; is inaccurate, 68; emphasizes negative, failure, and cost, 49; reporters are not knowledgeable, 45; is biased, 41;

reporters do not understand the meanings of numbers, 35; and is alarmist, 29. The remaining negative aspects and the number of times mentioned are in Appendix C.

SUGGESTIONS

The scientists and engineers were asked to list suggestions for improving the relationship of reporters and scientists. In general, the suggestions tend to place the burden of responsibility on the press. The most often mentioned was the idea that reporters should have some training in science. This was proposed by 73 respondents. The second most popular suggestion was that the scientist – or a scientist – should be allowed to review science articles before publication. This is consistent with the answer to the scale question that tapped the same belief. Other suggestions and the number of times mentioned are: promote better communications between the two, 34; scientists need training in communicating, 29; reporters should do their homework, 24; and hold conferences and opportunities for frequent contact, 22. Additional suggestions and the number of times they were mentioned are in Appendix C.

COMMENTS

The open-ended questions elicited a number of comments, some rather interesting, from the respondents. It would not be feasible to present all of them, but a small sample is given here to illustrate the tenor of the responses. "Reporters should stress to the public the need to understand general concepts,

not details; e.g., most of the public think science is too hard for them to understand and to use. But they don't have to know details. For instance, few take economics courses, yet the papers are filled with stock market, budget, and financial news -- because people realize that useful news doesn't require detailed understanding. Science, however is seen in a different light, and it shouldn't be."

"'Pseudo-scientists,'" or scientists with views far out of touch with the thinking of most scientists, are often presented as experts giving their views equal credence with those of 'mainstream' scientists in the eyes of the public."

"Reporters want to write stories that help sell newspapers! This leads them to place too much emphasis on any bizarre, controversial or negative aspects of the work -- or, on the other hand, to 'over sell' the story with promises of fantastic benefits to the public that are unrealistic. In any interviews that I give in the future, the reporter must first promise not to use the words: 'guru,' 'holy grail' or 'assault rifle' at any place in the story."

"Coverage of nuclear power industry -- the press helped radicals put it in a grave. They never knew the scientific facts, just hysteria by Jane Fonda (not a scientist)! We will soon pay the price for this drastic mistake."

"Reporters should spend more effort getting the true facts about a given incident than looking for a story that is a 'better seller' even using faulty 'facts.'"

(Newspapers) "give the public a feel for activities that are occurring. Increased public awareness can often lead to increased emphasis in an area of need or force a problem to be addressed."

A suggestion is "for journalists to know enough about the science of a scientist (by pre-interview research) to be able to ask pertinent and penetrating questions (to penetrate the details and veneer of the science to get to important issues which relate to the needs of the common man or woman."

"Politeness is not in vogue anymore as far as the press is concerned. I wouldn't consider talking to anyone who is not polite."

"Reporters should remember that scientists will generally work in only one field; consequently, the scientist's lack of insight into another area (even if it is somehow related) should not be misconstrued as incompetence."

"Reporters should remember that most scientists have homes and families and are a part of the general public, too. This means that most scientists are not out to harm the environment or destroy civilizations with weapons, or provide medically unsound advice to the public."

A suggestion was "less filtering of info by over-anxious corporate, PR bureaucrats."

"The press, while not always getting correct (sic), does a good job of looking beyond the 'good' science; i.e., what is the political, social, or economic impact."

"A reporter with an adequate level of technical understanding can provide great service both in explaining at a basic level to help to educate the public about science, but more important, to go on to interpret the significance of what is

reported and to raise critical questions (probably with help from scientists themselves for this aspect)."

"When scientific experts disagree, explaining the issues at the heart of the disagreement as clearly as possible is important to help the public understand the limits of knowledge and the ability of science to settle controversy (e.g., the area of creation and human origins)."

"Reporters should not hesitate to ask scientists for explanations and background reading material published for the educated layman. Professional societies often can help with this."

"The press has been fairer in coverage of how less hazardous dioxin and asbestos are than has the government."

"Press coverage many times reports the extreme side of an issue without regard for the facts because it is the 'popular' point of view. This adds to the misinformation that already exists. It also causes public officials and politicians to take up the popular cause creating more damage."

"They are poorly prepared. An English major can't understand differential equations (or even simple cause and effect relationships, sometimes)."

"The two opposing principles in reporting information need to be resolved. A fundamental principle in scientific publication is accuracy, whereas a, perhaps the, fundamental principle in media reporting is press freedom. Some compromise is needed."

"The most pervasive characteristic of newspapers is the ever present and oppressive "deadline." Newspaper reporters are always obsessed with the deadline and never seem to be able to do a story like they really would like to. Magazines and books are a bit better with regard to the press of time, but even here the product must be delivered in a timely manner. Accuracy is an elusive concept, even for scientists, and under the pressure of the deadline concern for it is clearly secondary. With regard to extreme points of view, they are simply better news than a description of dry data, so the tend to be emphasized. The relative importance of certain points from the viewpoint of a reporter is also certainly influenced by newsworthiness."

"Talk to us more, and talk to more of us."

CHAPTER 4

"The continuation of civilization as we know it depends on science, and the continuation of science would seem to depend on our ability to examine this sphere of human activity objectively and relate it to its human context."

-- Lynn White, Jr.

CONCLUSIONS

The results of the survey indicate very strong opinions in some areas of questioning about newspapers, the presentation of science, and the interaction of scientists and journalists. In other areas, the scientists and engineers were rather neutral. Confirmation of findings by Dunwoody, Ryan, Tankard, and others and quantifying of ideas expressed by the AAAS panel add to the body of evidence about the gulf between science and the media.

Overall, the respondents were fairly frequent newspaper readers. This can probably be attributed to the fact that they are better educated that the general population and were generally over the age of 40. Barely over one-half thought that there should be more science news in the newspapers. Perhaps, this is because they for the most part rated the local papers as "fair" in the handling of science news. More mediocrity would not be desirable.

The Likert scale question eliciting the most agreement stated that reporters should allow the scientist to check the story for inaccuracies before publication. This is a good indication of how scientists and engineers do not understand the working of the press. Not only are there time constraints, but most

importantly, the idea of checking a story may appear to be the right to censorship to the reporter. Censorship cannot be permitted. The perception of inaccuracies in newspapers probably accounts for much of the negative view that scientists and others express. Allowing a scientist to check a story would not automatically result in a better story. Certainly, reporters and writers must be very careful to be accurate in their reporting and to seek clarification whenever needed. Because the scientists indicated willingness to cooperate in the interest of getting the story correct, reporters should take advantage of that whenever possible. Most newspaper readers have noted stories about which they had enough knowledge to detect slight errors. Unfortunately, these slight errors work against the credibility of the press in the eyes of the public. The same situation is true for reporting of science news.

The statement that accuracy does not mean the same thing to a scientist that it does to a newspaper reporter elicited rather consistent agreement. The scientist whose name is misspelled will naturally rate accuracy low, as will the scientist who perceives that risk was not communicated properly, or the one who feels that the story does not present his or her view of a controversial issue. Clearly, this is an area where the burden is on the scientist to work with the reporter to ensure that accuracy is not compromised. This is the area where the scientist must communicate in layman's terms to the reporter to enable the reporter to explain to the general public. A tiny inaccuracy can be perceived as a major flaw, a huge inaccuracy. As one writer pointed out, scientists and reporters

may disagree on where to put the decimal point. Scientists insist on the accuracy of a micrometer, while a yardstick might do for a reporter.

The respondents disagreed with the statement that newspapers do a "good job of reporting science news in my field." A similar question that tapped opinions of the presentation of science in other fields brought responses closer to neutral. These data agree with previous studies by Dunwoody and Scott and others. The survey did not elicit the possible reasons for these opinions so one can only assume that they are based on the negative aspects of press coverage of science as shown in other of the scale questions. An additional possibility raised by some respondents is that coverage in their fields, due to the highly technical nature and lack of newsworthiness, is virtually nil.

Two other questions with which the majority agreed were that scientists and reporters would disagree over the importance of information in a story and that headlines are often misleading. The disagreement over importance given to information in a story is perhaps another aspect of accuracy with a little sensationalism thrown in. The reporter might focus on the materials contaminating the bottom of a lake, while the scientist might see this as not presenting a health hazard and not worthy of "play" in the press.

The problems of headlines are often cited both in science and other types of news. Because they must be written hurriedly and must also be brief, the chances of writing something that could be construed as misleading is relatively high.

Mild agreement was found on two other statements: the press is valuable in helping the scientist communicate with the public and newspapers should be more critical of science. If the press is not valuable in helping the scientist communicate with the public, one must wonder who is? The scientists do not go directly to the public. The average citizen does not read refereed journals. It would appear that the greatest conduit of scientific information to the public has to be through the media, including television in this instance, whether the scientists believe it or not. The so-called "visible scientists" are well aware of the role of the media in presenting their science and their agendas.

The remaining three scale items hovered around neutral. They were: scientists have a lot to lose if they deal with the press; reporters are disrespectful of scientists; and reporters are generally fair to science. Strangely enough, this neutrality might be construed as a positive for the press. 'Tis better that they are neutral than strongly negative, one might surmise.

From this study it is apparent that the attitudes of Oak Ridge scientists are consistent with encountered in other studies, such as done by Dunwoody, Scott, Tankard, and Ryan. Evidently, the scientists and engineers within Martin Marietta see issues in this study as important. This is evidenced by the response rate and by the fact that many of the respondents took time from busy schedules to answer the questionnaire and, in particular, to supply written answers to the open-ended questions. A number of the respondents wrote opinions and suggestions far beyond what was requested. Others telephoned to discuss the issues. Clearly, many

of the scientists and engineers are concerned and welcomed the opportunity to express their opinions.

The open-ended questions revealed that the scientists place most of the blame for poor relationships on the media rather than on the themselves. This is to be expected. A similar survey of newspaper reporters would probably reveal that the difficulty lies with the scientists. Indeed, some of this was seen in answers by some of the applied scientists who indicated that the scientists should attempt to explain their work in ways that the reporters could understand. In some ways, it appears that the answers are stereotypical; that is, the scientist or engineer has heard that he or she should bash the news media and used this opportunity to do so.

A couple of good examples of how scientists do not understand the nature of the press comes about with the frequent mentioning that the press "sensationalizes" the news to "sell newspapers." Most newspaper sales are generated by subscriptions; therefore, the papers see no significant fluctuations in sales whether the news is sensational or not. Most newspaper revenue is generated by advertising. "Selling papers" is not the driving force behind the play of the news, despite what the respondents believed. The questionnaire referred to the local newspapers, not tabloids and "check-out counter" publications.

Are there "two cultures" as C. P. Snow postulated? That supposition has been debated for a number of years by people who present good arguments on both sides of the issue. It is fairly safe to say that journalists and scientists perceive

the operation of the media differently; and in that respect, one could argue that there are, indeed, two cultures. The research, however, does not appear to substantiate the view that scientists and journalists are at opposite poles in the overall scheme of things. The disagreement focuses on the components of the communication–how the job is done, but not the fact that it is done.

The survey indicates that even though scientists do not, in general, feel that the media do a very good job of communicating science, these same scientists do favor questioning of scientific endeavors by the media. The studies that were reviewed and the survey itself did not address what constitutes a "good" job. Scientists, therefore, may not feel that the media are accurate in reporting science; that is, journalists make errors in reporting. Or the scientists may feel that "good" refers to quantity of science news or amount of detail in a science story. Certainly, all of these complaints receive coverage in the plethora of didactic essays and books the scientists and media critics write on the subject of the press and science.

The survey did not attempt to discover whether those scientists who favored criticism of science by the media based their opinions on belief in freedom of the press or advocacy of the watchdog role. Espousing a belief in the freedom of the press may not, in the view of these respondents, be the same as taking a scientific endeavor to task for running over its budget, having uncertain aims, being of dubious benefit to society.

Goldsmith and Goodfield, among others, saw the science critic as some specially trained person on the outside to look at science as it fits into the grand

scheme of things, a kind of a visionary. Nelkin, however, sees the media as fulfilling this function in its watchdog role, breaking through the hype to see the wider implications of science in the economic, political, and social context. Certainly, the role of the science journalist as critic has support even among scientists.

Further investigation of this subject matter could provide additional insight. What is the role of the science critic according to the scientists who ply their trade every day in the work place? Do these scientists perceive the polarity mentioned by many of the essayists and critics of the media? After all, the preponderance of the scientific population is not some elite group requiring deferential treatment and living apart from the remainder of society. Additional research should be done on the differences between the engineers and scientists and their views of the press.

With the limited resources available for scientific research, it is important that funds and effort be expended in the most useful ways for the benefit of mankind. The journalist as science critic can play an important part in communicating both positive and negative aspects of scientific endeavors to the public.

This study has identified some of the areas of disagreement and contention. Other studies should be undertaken to uncover other areas in need of scrutiny with an eye toward finding ways to work toward cooperation and understanding. The importance of increased opportunities for contact between scientists and

journalists should not be overlooked. The scientists have expressed a desire for such contacts. Many of the respondents cited the importance of conferences and seminars as sources of information in their scientific fields. Such conferences and seminars focusing on communication would be mutually beneficial. Perhaps, if scientists were more aware of the conditions under which the journalist must operate, they would be more understanding. Additionally, the scientists would benefit from a refresher course on the role of the free press in our society. "Selling newspapers" is not all bad. If newspapers are not economically viable, they cannot exist unless they are run by the state, a deplorable thought in our free society. Scientists today cannot operate in a vacuum. They need public support for their research. Because of pressure from certain interest groups, huge amounts of money are being funneled into Acquired Immune Deficiency Syndrome research, perhaps at the expense of research in other areas of health. Nevertheless, this serves as an example of how public pressure can affect funding for research.

Many scientists felt that newspaper reporters should have some training in science, at least in the philosophy of science and how science works. This could be accomplished in schools of journalism through courses in the philosophy of science and requirements for course work in scientific fields and in statistics. By the same token, courses in communication would be beneficial to the students in the scientific fields, both in honing their writing skills and giving them a deeper appreciation for the role of the media in American life. There is a need for "Physics for Poets 101" and for "The Media and the Microbiologist 101."

One of the most important recommendations to come from this study is the suggestion that Martin Marietta Energy Systems and the University of Tennessee College of Communications develop a conference for scientists and engineers and journalists and writers to be held annually in the East Tennessee Resource Valley. This conference could bring together eminent scientists and prominent writers for the interchange of ideas on the presentation of science.

Obviously, it is imperative that so important a topic as communicating science receives further study.

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APPENDICES

APPENDIX A

The frequencies and percentages are in bold type.

1. Which of these newspapers have you read the most frequently?
   66% **8.4%** **28.3%** **13.1%**
   311 *Knoxville News-Sentinel* 39 *Knoxville Journal*** 132 *Oak Ridger* 61 Other (specify)_____

2. Approximately how many times a week do you read the paper checked in question 1? _____
   0, 11, 2.4%; 1, 47, 10.1%; 3, 30, 6.5%; 4, 24, 5.2%; 5, 57, 12.3%; 6, 94, 20.2%; 7, 174, 37.4%
3. What is your opinion of the amount of science news coverage in that newspaper?
   51.6% **37.6%** **1.3%** **6.9%**
   240 not enough 175 about the right amount _6_ too much 32_ no opinion

4. How would you rate the quality of coverage of science news in the local papers?

		17.8%		**36.8%**		**29.7%**		**10.1%**
Knoxville News-Sentinel	_0_ Excellent	83_	Good	171_	Fair	138_	Poor	47_ No Opinion
		2.6%		**11.6%**		**12.5%**		**37.4%**
Knoxville Journal	0_ Excellent	12_	Good	54_	Fair	58_	Poor	174 No Opinion
	3%	**21.4%**		**19.1%**		**7.5%**		**25.3%**
Oak Ridger	14_ Excellent	100	Good	89_	Fair	35_	Poor	118 No Opinion

5. Where do you obtain most of the science news in your field? (Please rank in order with "1" for the most information. Use "0" to show little or no information.)

   ___ Newspapers ___ Magazines ___ Technical/Scientific Journals ___ Television ___ Radio

   ___ Professional Peers ___ Other

6. Please provide the names of specific sources of science news you rely on most.

   1. _____ 4. _____

   2. _____ 5. _____

   3. _____

7. Where do you obtain most of the science news in other fields? (Please rank in order with "1" for most information. Use "0" to show little or no information.)

   ___ Newspapers ___ Magazines ___ Technical/Scientific Journals ___ Television ___ Radio

   ___ Professional Peers ___ Other

8. Has a newspaper reporter ever contacted you about your scientific work? **28.4%** 132 Yes **71.6%** 333 No

9. If you answered "yes" to the previous question, approximately how many times have you been contacted by the press about your scientific work? _____
   1-2, 59, 46.5%; 3-4, 23, 18.1%; 5-6, 18, 14.2%; 7-8, 4, 3.1%; 9 and up, 23, 18.1% (n=127)
10. If you have dealt with reporters about your work, how would you categorize the experience?
    1.5% **18.5.%** **49.2%** **12.3%** **5.4%** **13.1% (n=130)**
    2_ Extremely good 24_ Very good 64_ Average 16_ Very Poor 7_ Extremely Poor _17_ No Opinion

** *Prior to the demise of the daily*

Please respond to the following questions by checking the column that most nearly agrees with your opinion.

	strongly agree	agree	mildly agree	neutral	mildly disagree	disagree	strongly disagree
11. Newspapers do a good job of reporting scientific endeavors in my field.	0.2% _1_	4.7% _22_	20.2% _94_	18.1% _84_	18.1% _84_	30.1% _140_	7.3% _34_
12. Newspapers do a good job of reporting science outside my field.	_0_	7.2% _33_	22.6% _103_	21.9% _100_	20.8% _95_	24.6% _112_	2.9% _13_
13. "Accuracy" does not mean the same thing to a reporter that it does to a scientist.	36.1% _168_	42.6% _199_	11% _30_	6.5% _30_	1.3% _6_	1.1% _5_	0.4% _2_
14. Newspapers give too much emphasis to "extremists" in order to present both sides of a story.	20.7% _96_	38.1% _177_	17.9% _83_	15.5% _72_	3.2% _15_	2.1% _10_	0.4% _2_
15. Scientists and reporters are likely to disagree about the importance given to information in a story.	18.9% _88_	54.4% _253_	14.8% _69_	8.0% _37_	1.9% _9_	0.9% _4_	0.2% _1_
16. The press is valuable in helping scientists communicate with the public.	15.5% _72_	36.8% _172_	18.7% _87_	10.3% _48_	8.8% _41_	6.7% _31_	2.4% _11_
17. Scientists have a lot to lose if they deal with the press.	3.9% _18_	9.5% _44_	17.0% _79_	27.5% _128_	16.1% _75_	20.6% _96_	4.9% _23_
18. A reporter should allow the scientist to check a story for inaccuracies before publication.	46% _214_	38.7% _180_	7.3% _34_	4.5% _21_	1.1% _5_	0.9% _4_	0.6% _3_
19. Headlines for science stories are often misleading.	24.9% _116_	38.7% _180_	19.9% _93_	12.4% _58_	2.2% _10_	0.4% _2_	0.4% _2_
20. The press should be more critical of science (asking such questions as "What are the stakes?" "Who pays?").	5.4% _25_	22.6% _105_	23.5% _109_	29.7% _138_	9.7% _45_	4.7% _22_	2.6% _12_
21. Reporters are too disrespectful of scientists.	1.3% _6_	5.8% _59_	10.5% _49_	53.5% _249_	14% _65_	12.5% _58_	1.1% _5_
22. Reporters are generally fair to science.	0.2% _1_	12.7% _59_	24% _112_	34.4% _160_	16.8% _78_	9% _42_	1.9% _9_

The next three questions allow you to provide any thoughts that you might have about scientists and the media.

23. Please list any *positive* aspects that you have observed in press coverage of science.

    1.

    2.

    3.

24. Please list any *negative* aspects that you have observed in press coverage of science.

    1.

    2.

    3.

25. Please list any suggestions you have for improving the relationship of reporters and scientists.

    1.

    2.

    3.

26. Which category best describes your occupation?

    34 8.8% Physical/life science (e.g., biology, astronomy, chemistry, geology, mathematics, statistics, and physics)

    158 24.1% Applied science (e.g., engineering, medicine, computer/information sciences, geodetic sciences, natural resources)

    297 33.5% Other. Please indicate _____

    10 2% Age: 41 8.8% 20 through 29 112 24.1% 30 through 39 156 33.5% 40 through 49 100 21.7% 50 through 59 54 11.6% 60 and over

27. Highest level of education: 6 1.3% high school 89 19.1% B.S./B.A. 86 18.5% B.S./B.A. plus 74 15.9% M.S./M.A./M.B.A. 74 15.9% M.S./M.A./M.B.A. plus 128 27.5% Ph.D. 48 10.3% Postdoctorate

28.

Please fold the questionnaire, place it in the enclosed envelope, and drop it in the plant mail.
Thank you!

APPENDIX B

Table 1. Frequency distribution for newspapers and opinions on amount of science news

	No Answer	Not Enough	About Right	Too Much	No Opinion	Total
News-Sentinel	4 (1.3%)	187 (60.1%)	91 (29.3%)	4 (1.3%)	25 (8.0%)	311 (100%)
Journal		25 (64.1%)	10 (25.6%)	1 (2.6%)	3 (7.7%)	39 (100%)
Oak Ridger	6 (4.5%)	39 (29.5%)	82 (62.1%)	2 (1.5%)	2 (1.5%)	131 (100%)
Other	4 (6.6%)	27 (44.3%)	24 (39.3%)	2 (3.3%)	4 (6.6%)	61 (100%)
n =	14	278	207	9	34	542

Table 2. Occupation by question: "Newspapers do a good job of reporting scientific endeavors in my field."

	Phys/Life Science	Applied Science	Other	Total
No Answer	2 (0.6%)	2 (0.7%)	2 (20%)	6 (1.3%)
Agree	36 (23%)	79 (27%)	2 (20%)	117 (25.2%)
Neutral	26 (16%)	57 (19%)	1 (10%)	84 (18.1%)
Disagree	94 (59%)	159 (54%)	5 (50%)	258 (55.5%)
Total	158 (34.0%)	297 (63.9%)	10 (2.2%)	465 (100%)

Chi-square = 30.22, p <.01

Table 3. Occupation by question: "Newspapers do a good job of reporting science outside my field."

	Phys/Life Science	Applied Science	Other	Total
No Answer	4 (2%)	3 (2%)	2 (20%)	9 (1.9%)
Agree	36 (23%)	100 (33%)		136 (29.2%)
Neutral	39 (25%)	59 (20%)	2 (20%)	100 (21.5%)
Disagree	79 (50%)	135 (45%)	6 (60%)	220 (47.3%)
Total	158 (34.0%)	297 (63.9%)	10 (2.2%)	465 (100%)

Chi-square = 27.55, p <.01

Table 4. Occupation by question: "'Accuracy' does not mean the same thing to a reporter that it does to a scientist."

	Phys/Life Science	Applied Science	Other	Total
No Answer	1 (1%)	2 (1%)	1 (10%)	4 (0.9%)
Agree	139 (88%)	270 (90%)	9 (90%)	418 (89.9%)
Neutral	14 (8%)	16 (5%)		30 (6.5%)
Disagree	4 (3%)	9 (4%)		13 (2.8%)
Total	158 (34.1%)	297 (63.8%)	10 (2.2%)	465 (100%)

Chi-square = 12.99, p <.05

Table 5. Occupation by question: "Newspapers give too much emphasis to 'extremists' in order to present both sides of a story."

	Phys/Life Science	Applied Science	Other	Total
No Answer	3 (3%)	5 (2%)	1 (10%)	9 (1.9%)
Agree	119 (75%)	229 (77%)	8 (80%)	356 (76.7%)
Neutral	29 (18%)	42 (14%)	1 (10%)	72 (15.5%)
Disagree	7 (4%)	20 (7%)		27 (5.8%)
Total	158 (34.1%)	297 (63.8%)	10 (2.2%)	465 (100%)

Chi-square = 6.42, p >.10

Table 6. Occupation by question: "Scientists and reporters are likely to disagree over the importance given to information in a story."

	Phys/Life Science	Applied Science	Other	Total
No Answer		2 (1%)	2 (20%)	4 (0.9%)
Agree	135 (85%)	267 (90%)	8 (80%)	410 (88.2)%
Neutral	19 (12%)	18 (6%)		37 (8.0%)
Disagree	4 (3%)	10 (3%)		14 (3.0%)
Total	158 (34%)	297 (63.9%)	10 (2.2%)	465 (100%)

Chi-square = 50.35, p <.01

Table 7. Occupation by question: "The press is valuable in helping scientists communicate with the public."

	Phys/Life Science	Applied Science	Other	Total
No Answer	1 (1%)	1 (0%)	1 (10%)	3 (0.6%)
Agree	107 (67%)	217 (73%)	7 (70%)	331 (71.2)%
Neutral	20 (13%)	28 (20%)		48 (10.3%)
Disagree	30 (19%)	51 (17%)	2 (20%)	83 (17.8%)
Total	158 (34%)	297 (63.9%)	10 (2.2%)	465 (100%)

Chi-square = 16.73, p <.01

Table 8. Occupation by question: "Scientists have a lot to lose if they deal with the press."

	Phys/Life Science	Applied Science	Other	Total
No Answer		1 (0%)	1 (10%)	2 (0.4%)
Agree	40 (25%)	94 (32%)	7 (70%)	141 (30.3%)
Neutral	37 (23%)	91 (31%)		128 (27.5%)
Disagree	81 (52%)	111 (37%)	2 (20%)	194 (41.7%)
Total	158 (34%)	297 (63.9%)	10 (2.2%)	465 (100%)

Chi-square = 39.40, p <.01

Table 9. Occupation by question: "Headlines for science stories are often misleading."

	Phys/Life Science	Applied Science	Other	Total
No Answer	2 (1%)	1 (0%)	1 (10%)	4 (0.9%)
Agree	131 (83%)	250 (85%)	8 (80%)	389 (93.7%)
Neutral	18 (12%)	39 (13%)	1 (10%)	58 (12.5%)
Disagree	7 (4%)	7 (2%)		14 (3.0%)
Total	158 (34%)	297 (63.9%)	10 (2.2%)	465 (100%)

Chi-square = 13.08, p <.05

Table 10. Occupation by question: "The press should be more critical of science (asking such questions as "What are the stakes?" "Who pays?")

	Phys/Life Science	Applied Science	Other	Total
No Answer	4 (2.5%)	3 (1.0%)	1 (10%)	8 (1.7%)
Agree	84 (53.5%)	147 (49.5%)	8 (80%)	239 (51.5%)
Neutral	36 (22.9%)	102 (34.3%)		138 (29.7%)
Disagree	33 (21.0%)	45 (15.2%)	1 (10%)	79 (17.0%)
Total	157 (33.8%)	297 (64.0%)	10 (2.2%)	464 (100%)

Chi-square = 17.31, p <.01

Table 11. Occupation by question: "Reporters are too disrespectful of scientists."

	Phys/Life Science	Applied Science	Other	Total
No Answer	2 (1.3%)	3 (1.0%)	1 (10%)	6 (1.3%)
Agree	19 (12.0%)	61 (20.5%)	2 (20%)	82 (17.6%)
Neutral	79 (50%)	166 (55.9%)	4 (40%)	249 (53.5%)
Disagree	58 (21.0%)	67 (15.2%)	3 (10%)	128 (27.5%)
Total	158 (34.0%)	297 (63.9%)	10 (2.2%)	465 (100%)

Chi-square = 18.88, p <.01

Table 12. Occupation by question: "Reporters are generally fair to science."

	Phys/Life Science	Applied Science	Other	Total
No Answer		3 (1.0%)	1 (10%)	4 (.9%)
Agree	57 (36.1%)	112 (37.7%)	3 (30%)	172 (37%)
Neutral	64 (40.5%)	93 (31.3%)	3 (30%)	160 (34.4%)
Disagree	37 (23.4%)	89 (30.0%)	3 (30%)	129 (27.7%)
Total	158 (34.0%)	297 (63.9%)	10 (2.2%)	465 (100%)

Chi-square = 15.56, p <.01

Table 13. Education by question: "Newspapers do a good job of reporting scientific endeavors in my field."

	H.S.	BS/BA	BS/BA+	MS/MBA	MS/MBA+	Ph.D.	Postdoc.	Total
No Answer		1 (1%)	1 (1%)			2 (2%)	2 (4%)	6 (1.3%)
Agree	2 (33%)	2 (31%)	18 (21%)	21 (28%)	8 (24%)	29 (23%)	11 (22%)	117 (25.2%)
Neutral	1 (17%)	22 (25%)	12 (14%)	13 (18%)	7 (21%)	23 (18%)	6 (12%)	84 (18.1%)
Disagree	3 (50%)	38 (43%)	55 (64%)	40 (54%)	18 (55%)	74 (58%)	30 (61%)	258 (55.5%)
Total	6 (1.3%)	89 (19.1%)	86 (18.5%)	74 (15.9%)	33 (7.1%)	128 (27.5%)	49 (10.5%)	465 (100%)

Chi-square = 15.79, p >.10

Table 14. Education by question: "Newspapers do a good job of reporting science outside my field."

	H.S.	BS/BA	BS/BA+	MS/MBA	MS/MBA+	Ph.D.	Postdoc.	Total
No Answer		1 (1%)	1 (1%)			5 (4%)	2 (4%)	9 (1.9%)
Agree	2 (33%)	39 (44%)	24 (27.9%)	17 (22%)	11 (33%)	31 (24%)	12 (24%)	136 (29.2%)
Neutral	1 (17%)	16 (18%)	17 (20%)	19 (26%)	6 (18%)	31 (24%)	10 (20%)	100 (21.5%)
Disagree	3 (50%)	33 (37%)	44 (51%)	38 (51%)	16 (48%)	61 (47%)	25 (51%)	220 (47.3%)
Total	6 (1.3%)	89 (19.1%)	86 (18.5%)	74 (15.9%)	33 (7.1%)	128 (27.5%)	49 (10.5%)	465 (100%)

Chi-square = 20.30, p >.10

Table 15. Education by question: "'Accuracy' does not mean the same thing to a reporter that it does to a scientist."

	H.S.	BS/BA	BS/BA+	MS/MBA	MS/MBA+	Ph.D.	Postdoc.	Total
No Answer		1 (1%)		1 (1%)		1 (1%)	1 (2%)	4 (0.9%)
Agree	6 (100%)	80 (90%)	79 (92%)	68 (92%)	29 (88%)	111 (87%)	45 (92%)	418 (89.9)%
Neutral		6 (7%)	3 (3%)	3 (4%)	4 (12%)	12 (9%)	2 (4%)	30 (6.5%)
Disagree		2 (2%)	4 (5%)	2 (3%)		4 (3%)	1 (2%)	13 (2.8%)
Total	6 (1.3%)	89 (19.1%)	86 (18.5%)	74 (15.9%)	33 (7.1%)	128 (27.5%)	49 (10.5%)	465 (100%)

Chi-square = 10.87, p >.10

Table 16. Education by question: "Newspapers give too much emphasis to "extremists" in order to give both sides of a story."

	H.S.	BS/BA	BS/BA+	MS/MBA	MS/MB A+	Ph.D.	Postdoc.	Total
No Answer		3 (3%)	1 (1%)	1 (1%)		3 (2%)	1 (2%)	9 (0.9%)
Agree	5 (8%)	66 (74%)	64 (74%)	61 (82%)	26 (78%)	95 (74%)	39 (79%)	356 (76.7)%
Neutral	1 (16%)	12 (13%)	13 (15%)	8 (11%)	5 (15%)	25 (20%)	8 (16%)	72 (15.5%)
Disagree		7 (7%)	8 (9%)	4 (5%)	2 (6%)	5 (3%)	1 (2%)	27 (5.8%)
Total	6 (1.3%)	89 (19.1%)	86 (18.5%)	74 (15.9%)	33 (7.1%)	128 (27.5%)	49 (10.5%)	465 (100%)

Chi-square = 17.70, p >.10

Table 17. Education by question: "Scientists are likely to disagree over the importance given to information in a story."

	H.S.	BS/BA	BS/BA +	MS/MB A	MS/MB A+	Ph.D.	Postdoc.	Total
No Answer		1 (1%)	1 (1%)				2 (4%)	4 (0.9%)
Agree	6 (100%)	84 (95%)	76 (89%)	66 (89%)	32 (97%)	107 (83%)	39 (80%)	410 (88.2)%
Neutral		3 (3%)	6 (7%)	6 (8%)	1 (3%)	15 (12%)	6 (12%)	37 (8.0%)
Disagree		1 (1%)	3 (3%)	2 (3%)		6 (5%)	2 (4%)	14 (3.0%)
Total	6 (1.3%)	89 (19.1%)	86 (18.5%)	74 (15.9%)	33 (7.1%)	128 (27.5%)	49 (10.5%)	465 (100%)

Chi-square = 20.69, p >.10

Table 18. Education by question: "The press is valuable in helping scientists communicate with the public."

	H.S.	BS/BA	BS/BA+	MS/MBA	MS/MBA+	Ph.D.	Postdoc.	Total
No Answer		1 (1%)					2 (4%)	3 (0.6%)
Agree	5 (83%)	69 (78%)	60 (70%)	53 (72%)	22 (67%)	88 (69%)	34 (70%)	331 (71.2)%
Neutral	1 (17%)	9 (10%)	7 (8%)	8 (11%)	5 (15%)	14 (11%)	4 (8%)	48 (10.3%)
Disagree		10 (11%)	19 (22%)	13 (17%)	6 (18%)	26 (20%)	9 (18%)	83 (17.8%)
Total	6 (1.3%)	89 (19.1%)	86 (18.5%)	74 (15.9%)	33 (7.1%)	128 (27.5%)	49 (10.5%)	465 (100%)

Chi-square = 18.50, p >.10

Table 19. Education by question: "Scientists have a lot to lose if they deal with the press."

	H.S.	BS/BA	BS/BA+	MS/MBA	MS/MBA +	Ph.D.	Postdoc.	Total
No Answer		1 (1%)					1 (2%)	2 (0.4%)
Agree	2 (33%)	22 (25%)	33 (38%)	28 (38%)	11 (33%)	38 (30%)	7 (14%)	141 (30.3%)
Neutral	2 (33%)	37 (42%)	18 (21%)	19 (26%)	9 (27%)	33 (26%)	10 (20%)	128 (27.5%)
Disagree	2 (34%)	29 (32%)	35 (41%)	27 (35%)	13 (40%)	57 (44%)	31 (64%)	194 (41.7%)
Total	6 (1.3%)	89 (19.1%)	86 (18.5%)	74 (15.9%)	33 (7.1%)	128 (27.5%)	49 (10.5%)	465 (100%)

Chi-square = 30.86, p <.01

Table 20. Education by question: "Headlines for science stories are often misleading."

	H.S.	BS/BA	BS/BA+	MS/MBA	MS/MBA+	Ph.D.	Postdoc.	Total
No Answer		1 (1%)				3 (2%)		4 (0.9%)
Agree	5 (83%)	71 (80%)	75 (87%)	65 (88%)	25 (76%)	106 (83%)	42 (86%)	389 (83.7%)
Neutral		14 (16%)	10 (12%)	8 (11%)	8 (24%)	13 (10%)	5 (10%)	58 (12.5%)
Disagree	1 (17%)	3 (3%)	1 (1%)	1 (1%)		6 (5%)	2 (4%)	14 (3.0%)
Total	6 (1.3%)	89 (19.1%)	86 (18.5%)	74 (15.9%)	33 (7.1%)	128 (27.5%)	49 (10.5%)	465 (100%)

Chi-square = 20.13, p >.10

Table 21. Education by question: "The press should be more critical of science (asking such questions as "What are the stakes?" "Who pays?")

	H.S.	BS/BA	BS/BA+	MS/MBA	MS/MBA+	Ph.D.	Postdoc.	Total
No Answer	1 (16.7%)	1 (1.1%)		1 (12.5%)		4 (50%)	1 (2.1%)	8 (1.7%)
Agree	4 (66.7%)	42 (47.2%)	41 (47.7%)	40 (54.1%)	20 (60.6%)	65 (50.8%)	27 (56.3%)	239 (51.5%)
Neutral	1 (16.7%)	32 (36%)	32 (37.2%)	18 (24.3%)	9 (27.3%)	33 (25.8%)	13 (27.1%)	138 (29.7%)
Disagree		14 (15.7%)	13 (15.1%)	15 (20.3%)	4 (12.1%)	26 (20.3%)	7 (14.6%)	14 (3.0%)
Total	6 (1.3%)	89 (19.1%)	86 (18.5%)	74 (15.9%)	33 (7.1%)	128 (27.6%)	48 (10.3%)	465 (100%)

Chi-square = 21.14, p >.10

Table 22. Education and scale question: "Reporters are too disrespectful of scientists."

	H.S.	BS/BA	BS/BA+	MS/MBA	MS/MBA+	Ph.D.	Postdoc.	Total
No Answer		1 (1.1%)	1 (1.2%)	1 (1.4%)		2 (1.6%)	1 (2.0%)	6 (1.3%)
Agree		17 (19.1%)	16 (18.6%)	16 (21.6%)	16 (21.6%)	19 (14.8%)	5 (10.2%)	82 (17.6%)
Neutral	5 (83.3%)	54 (60.7%)	52 (60.5%)	36 (48.6%)	18 (54.5%)	59 (46.1%)	25 (51.%)	249 (53.5%)
Disagree	1 (16.7%)	17 (19.1%)	17 (19.8%)	21 (28.4%)	6 (18.2%)	48 (37.5%)	18 (36.7%)	128 (27.5%)
Total	6 (1.3%)	89 (19.1%)	86 (18.5%)	74 (15.9%)	33 (7.1%)	128 (27.6%)	49 (10.5%)	465 (100%)

Chi-square = 25.52, p >.10

Table 23. Education by question: "Reporters are generally fair to science."

	H.S.	BS/BA	BS/BA+	MS/MBA	MS/MBA+	Ph.D.	Postdoc.	Total
No Answer		2 (2.2%)	1 (1.2%)				1 (2.0%)	4 (.9%)
Agree	1 (16.7%)	33 (37.1%)	30 (34.9%)	25 (33.8%)	10 (30.3%)	50 (39.1%)	23 (46.9%)	172 (37.0%)
Neutral	5 (83.3%)	31 (34.8%)	26 (30.2%)	23 (31.1%)	13 (39.4%)	43 (33.6%)	19 (38.8)	160 (34.4%)
Disagree		23 (25.8%)	29 (33.7%)	26 (35.1%)	10 (30.3%)	35 (27.3%)	6 (12.2%)	129 (27.7%)
Total	6 (1.3%)	89 (19.1%)	86 (18.5%)	74 (15.9%)	33 (7.1%)	128 (27.6%)	49 (10.5%)	465 (100%)

Chi-square = 21.85, p >.10

Table 24. Age by question: "Newspapers do a good job of reporting scientific endeavors in my field."

	Not given	20-29	30-39	40-49	50-59	60 +	Total
No Answer				2 (1%)	3 (3%)	1 (19%)	6 (1.3%)
Agree		17 (41%)	24 (21%)	29 (19%)	29 (29%)	18 (33%)	117 (25.2%)
Neutral		7 (17%)	23 (21%)	23 (15%)	24 (24%)	7 (13%)	84 (18.1%)
Disagree	1 (100%)	17 (41%)	65 (58%)	102 (65%)	45 (45%)	28 (52%)	258 (55.5%)
Total	1 (0.2%)	41 (8.8%)	112 (24.1%)	156 (33.5%)	101 (21.7%)	54 (11.6%)	465 (100%)

Chi-square = 25.27, p <.05

Table 25. Age by question: "Newspapers do a good job of reporting science outside my field."

	Not given	20-29	30-39	40-49	50-59	60 +	Total
No Answer				5 (3%)	3 (3%)	1 (2%)	9 (1.9%)
Agree		17 (41%)	33 (29%)	34 (22%)	34 (33%)	18 (33%)	136 (29.2%)
Neutral		11 (27%)	22 (27%)	32 (21%)	22 (22%)	13 (24%)	100 (21.5%)
Disagree	1 (100%)	13 (31%)	57 (50%)	85 (54%)	42 (42%)	22 (41%)	220 (47.3%)
Total	1 (0.2%)	41 (8.8%)	112 (24.1%)	156 (33.5%)	101 (21.7%)	54 (11.6%)	465 (100%)

Chi-square = 18.24, p >.10

Table 26. Age by question: "'Accuracy' does not mean the same thing to a reporter that it does to a scientist."

	Not given	20-29	30-39	40-49	50-59	60 +	Total
No Answer			1 (1%)	2 (1%)		1 (2%)	4 (0.9%)
Agree		39 (95%)	100 (89%)	140 (90%)	89 (88%)	50 (93%)	418 (89.9%)
Neutral	1 (100%)	2 (5%)	8 (7%)	10 (6%)	8 (8%)	1 (2%)	30 (6.5%)
Disagree			3 (3%)	4 (3%)	4 (4%)	2 (3%)	13 (2.8%)
Total	1 (0.2%)	41 (8.8%)	112 (24.1%)	156 (33.5%)	101 (21.7%)	54 (11.6%)	465 (100%)

Chi-square = 21.05, p >.10

Table 27. Age by question: "Newspapers give too much emphasis to extremists in order to present both sides of a story."

	Not given	20-29	30-39	40-49	50-59	60 +	Total
No Answer				4 (2%)	3 (3%)	2 (4%)	9 (1.9%)
Agree		28 (68%)	86 (77%)	121 (78%)	77 (76%)	44 (81%)	356 (76.7%)
Neutral	1 (100%)	8 (20%)	16 (14%)	26 (17%)	14 (14%)	7 (7%)	72 (15.5%)
Disagree		5 (12%)	9 (9%)	5 (3%)	7 (7%)	1 (2%)	27 (5.8%)
Total	1 (0.2%)	41 (8.8%)	112 (24.1%)	156 (33.5%)	101 (21.7%)	54 (11.6%)	465 (100%)

Chi-square = 19.11, p >.10

Table 28. Age by question: "Scientists and reporters are likely to disagree over the importance given to information in a story."

	Not given	20-29	30-39	40-49	50-59	60 +	Total
No Answer				2 (1%)		2 (4%)	4 (0.9%)
Agree	1 (100%)	39 (95%)	104 (93%)	133 (85%)	85 (85%)	48 (89%)	410 (88.2)%
Neutral		2 (5%)	6 (5%)	15 (10%)	10 (10%)	4 (7%)	37 (8.0%)
Disagree			2 (2%)	6 (4%)	6 (6%)		14 (3.0%)
Total	1 (0.2%)	41 (8.8%)	112 (24.1%)	156 (33.5%)	101 (21.7%)	54 (11.6%)	465 (100%)

Chi-square = 17.80, p >.10

Table 29. Age by question:"The press is valuable in helping scientists communicate with the public."

	Not given	20-29	30-39	40-49	50-59	60 +	Total
No Answer				2 (1%)		1 (2%)	3 (0.6%)
Agree	1 (100%)	32 (78%)	79 (71%)	120 (77%)	65 (64%)	34 (63%)	331 (71.2)%
Neutral		5 (12%)	14 (12%)	11 (7%)	14 (14%)	4 (7%)	48 (10.3%)
Disagree		4 (10%)	19 (17%)	23 (15%)	22 (22%)	15 (28%)	83 (17.8%)
Total	1 (0.2%)	41 (8.8%)	112 (24.1%)	156 (33.5%)	101 (21.7%)	54 (11.6%)	465 (100%)

Chi-square = 16.61, p >.10

Table 30. Age by question: "Scientists have a lot to lose if they deal with the press."

	Not given	20-29	30-39	40-49	50-59	60 +	Total
No Answer				1 (0%)		1 (1%)	2 (0.4%)
Agree		12 (29%)	31 (27%)	45 (29.3%)	30 (30%)	23 (43%)	141 (30.3%)
Neutral		12 (29%)	40 (36%)	44 (28.3%)	26 (25%)	6 (11%)	128 (27.5%)
Disagree	1 (100%)	17 (41%)	41 (36%)	66 (42.3%)	45 (44%)	24 (44%)	194 (41.7%)
Total	1 (0.2%)	41 (8.8%)	112 (24.1%)	156 (33.5%)	101 (21.7%)	54 (11.6%)	465 (100%)

Chi-square = 17.48, p >.10

Table 31. Age by question: "Headlines for science stories are often misleading."

	Not given	20-29	30-39	40-49	50-59	60 +	Total
No Answer				3 (2%)	1 (1%)		4 (0.9%)
Agree	1 (100%)	32 (78%)	96 (86%)	127 (81%)	84 (83%)	49 (91%)	389 (83.7%)
Neutral		8 (20%)	14 (12%)	22 (14%)	9 (9%)	5 (9%)	58 (12.5%)
Disagree		1 (2%)	1 (2%)	4 (3%)	7 (7%)		14 (3.0%)
Total	1 (0.2%)	41 (8.8%)	112 (24.1%)	156 (33.5%)	101 (21.7%)	54 (11.6%)	465 (100%)

Chi-square = 15.60, p >.10

Table 32. Age by question: "The press should be more critical of science (asking such questions as "What are the stakes?" "Who pays?")

	Not given	20-29	30-39	40-49	50-59	60 +	Total
No Answer			1 (.9%)	2 (1.3%)	1 (1%)	4 (7.4%)	8 (1.7%)
Agree		21 (51.2%)	52 (46.4%)	79 (50.6%)	61 (61%)	26 (48.1%)	239 (51.5%)
Neutral		13 (31.7%)	40 (35.7%)	48 (30.8%)	19 (19%)	18 (33.3%)	138 (29.7%)
Disagree		13 (31.7%)	40 (35.7%)	48 (30.8%)	19 (19%)	6 (11.1%)	79 (17.0%)
Total	1 (0.2%)	41 (8.8%)	112 (24.1%)	156 (33.6%)	100 (21.6%)	54 (11.6%)	464 (100%)

Chi-square = 25.99, p <.05

Table 33. Age by question: "Reporters are too disrespectful of scientists."

	Not given	20-29	30-39	40-49	50-59	60 +	Total
No Answer				4 (2.6%)		2 (3.7%)	6 (1.3%)
Agree		6 (14.6%)	21 (18.8%)	25 (16%)	19 (18.8%)	11 (20.4%)	82 (17.6%)
Neutral		27 (65.9%)	63 (56.3%)	82 (52.6%)	52 (51.5%)	25 (46.3%)	249 (53.5%)
Disagree	1 (100%)	8 (19.5%)	28 (25.0%)	45 (28.8%)	30 (29.7%)	16 (29.6%)	128 (27.5%)
Total	1 (0.2%)	41 (8.8%)	112 (24.1%)	156 (33.5%)	101 (21.7%)	54 (11.6%)	465 (100%)

Chi-square = 14.66, p >.10

Table 34. Age by question: "Reporters are generally fair to science."

	Not given	20-29	30-39	40-49	50-59	60 +	Total
No Answer				2 (1.3%)	1 (1.0%)	1 (1.9%)	4 (0.9%)
Agree		15 (36.6%)	37 (33.0%)	55 (35.3%)	35 (34.7%)	30 (55.6%)	172 (37.0%)
Neutral	1 (100%)	17 (41.5%)	39 (34.8%)	52 (33.3%)	41 (40.6%)	10 (18.5%)	160 (34.4%)
Disagree		9 (22.0%)	36 (32.1%)	47 (30.1%)	24 (23.8%)	13 (24.1%)	129 (27.7%)
Total	1 (0.2%)	41 (8.8%)	112 (24.1%)	156 (33.5%)	101 (21.7%)	54 (11.6%)	465 (100%)

Chi-square = 18.14, p >.10

Table 35. Frequency of readership by question: "Newspapers do a good job of reporting scientific endeavors in my field."

	non-reader	1 day/week	2 days/week	3 days/week	4 days/week	5 days/week	6 days/week	7 days/week	Total
No Answer	1 (9%)	1 (2%)		1 (3%)			2 (2%)	1 (0.6%)	6 (1.3%)
Agree	3 (27%)	9 (19%)	6 (21%)	6 (20%)	6 (25%)	16 (28%)	26 (29%)	45 (26%)	117 (25.2%)
Neutral	3 (27%)	9 (19%)	6 (21%)	3 (10%)	3 (12%)	7 (12%)	13 (14%)	40 (23%)	84 (18.1%)
Disagree	4 (36%)	28 (59%)	16 (57%)	20 (67%)	15 (62%)	34 (60)%	53 (56%)	88 (51%)	250 (55.5%)
Total	11 (2.4%)	47 (10.1%)	28 (6.0%)	30 (6.5%)	24 (5.2%)	57 (12.3%)	94 (20.2%)	174 (37.4%)	465 (100%)

Chi-square = 19.90, p >.10

Table 36. Frequency of readership by question: "Newspapers do a good job of reporting science outside my field."

	non-reader	1 day/week	2 days/week	3 days/week	4 days/week	5 days/week	6 days/week	7 days/week	Total
No Answer	1 (9%)	1 (2%)		1 (3%)			2 (2%)	4 (2%)	9 (1.9%)
Agree	3 (29%)	10 (21%)	7 (15%)	6 (20%)	7 (29%)	21 (37%)	28 (30%)	54 (31%)	136 (29.2%)
Neutral	3 (27%)	15 (32%)	5 (11%)	8 (27%)	7 (29%)	10 (18%)	14 (15%)	38 (22%)	100 (21.5%)
Disagree	4 (37%)	21 (45%)	16 (34%)	15 (50%)	10 (42%)	26 (45%)	50 (53%)	78 (45%)	220 (47.3%)
Total	11 (2.4%)	47 (10.1%)	28 (6.0%)	30 (6.5%)	24 (5.2%)	57 (12.3%)	94 (20.2%)	174 (37.4%)	465 (100%)

Chi-square = 17.02, p >.10

Table 37. Frequency of readership by question: "'Accuracy' does not mean the same thing to a reporter that it does to a scientist."

	non-reader	1 day/week	2 days/week	3 days/week	4 days/week	5 days/week	6 days/week	7 days/week	Total
No Answer				1 (3%)		1 (2%)	1 (1%)	1 (1%)	4 (0.9%)
Agree	10 (91%)	40 (85%)	25 (89%)	27 (90%)	23 (96%)	51 (89%)	84 (90%)	158 (91%)	418 (89.9%)
Neutral	1 (9%)	4 (8%)	2 (7%)	1 (3%)	1 (4%)	2 (4%)	7 (7%)	12 (7%)	30 (6.5%)
Disagree		3 (7%)	1 (4%)	1 (4%)		3 (5%)	2 (2%)	3 (2%)	13 (2.8%)
Total	11 (2.4%)	47 (10.1%)	28 (6.0%)	30 (6.5%)	24 (5.2%)	57 (12.3%)	94 (20.2%)	174 (37.4%)	465 (100%)

Chi-square = 11.45, p >.10

Table 38. Frequency of readership by question: "Newspapers give too much emphasis to extremists in order to present both sides of a story."

	non-reader	1 day/week	2 days/week	3 days/week	4 days/week	5 days/week	6 days/week	7 days/week	Total
No Answer			1 (3%)	1 (3%)		2 (4%)	2 (2%)	3 (2%)	9 (1.9%)
Agree	9 (82%)	32 (68%)	23 (83%)	22 (76%)	17 (71%)	41 (71%)	77 (82%)	135 (77%)	356 (76.7%)
Neutral	1 (9%)	10 (21%)	3 (11%)	4 (14%)	6 (25%)	9 (16%)	12 (13%)	27 (16%)	72 (15.5%)
Disagree	1 (9%)	5 (11%)	1 (3%)	2 (7%)	1 (4%)	5 (9%)	3 (3%)	9 (5%)	27 (5.8%)
Total	11 (2.4%)	47 (10.1%)	28 (6.0%)	30 (6.3%)	24 (5.2%)	57 (12.3%)	94 (20.3%)	174 (37.5%)	465 (100%)

Chi-square = 12.53, p >.10

Table 39. Frequency of readership by question: "Scientists and reporters are likely to disagree over the importance given to information in a story."

	non-reader	1 day/week	2 days/week	3 days/week	4 days/week	5 days/week	6 days/week	7 days/week	Total
No Answer				1 (3.3%)			2 (2%)	1 (0%)	4 (0.9%)
Agree	11 (100%)	40 (85%)	26 (93%)	25 (83.3%)	21 (88%)	51 (89%)	78 (82.9%)	158 (91%)	410 (88.2)%
Neutral		3 (6%)	2 (7%)	4 (13.3%)	1 (4%)	4 (7%)	11 (11.7%)	12 (7%)	37 (8.0%)
Disagree		4 (9%)			2 (8%)	2	3	3 (2%)	14 (3.0%)
Total	11 (2.4%)	47 (10.1%)	28 (6.0%)	30 (6.5%)	24 (5.2%)	57 (12.3%)	94 (20.2%)	174 (37.4%)	465 (100%)

Chi-square = 20.90, p >.10

Table 40. Frequency of readership by question: "The press is valuable in helping scientists communicate with the public."

	non-reader	1 day/week	2 days/week	3 days/week	4 days/week	5 days/week	6 days/week	7 days/week	Total
No Answer				1 (3%)			2 (2%)		3 (0.6%)
Agree	8 (73%)	33 (70.2%)	21 (75%)	24 (80%)	20 (83%)	39 (69%)	63 (67%)	123 (70.6%)	331 (71.2%)
Neutral	2 (18%)	6 (13%)	2 (7%)	2 (7%)		7 (12%)	11 (20%)	18 (10%)	48 (10.3%)
Disagree	1 (9%)	8 (17%)	5 (18%)	3 (10%)	4 (17%)	11 (20%)	18 (19%)	33 (19%)	83 (17.8%)
Total	11 (2.4%)	47 (10.1%)	28 (6.0%)	30 (6.5%)	24 (5.2%)	57 (12.3%)	94 (20.2%)	174 (37.4%)	465 (100%)

Chi-square = 16.23, p >.10

Table 41. Frequency of readership by question: "Scientists have a lot to lose if they deal with the press."

	non-reader	1 day/week	2 days/week	3 days/week	4 days/week	5 days/week	6 days/week	7 days/week	Total
No Answer				1 (3%)			1 (1%)		2 (0.4%)
Agree	3 (28%)	13 (28%)	13 (46%)	10 (33%)	8 (33%)	17 (30%)	26 (28%)	51 (29%)	141 (30.3%)
Neutral	4 (36%)	16 (34%)	8 (29%)	9 (30%)	4 (17%)	15 (26%)	27 (29%)	45 (26%)	128 (27.5%)
Disagree	4 (36%)	18 (38%)	7 (25%)	10 (34%)	12 (50%)	25 (44%)	40 (43%)	78 (45%)	194 (41.7%)
Total	11 (2.4%)	47 (10.1%)	28 (6.0%)	30 (6.5%)	24 (5.2%)	57 (12.3%)	94 (20.2%)	174 (37.4%)	465 (100%)

Chi-square = 17.07, p >.10

Table 42. Frequency of readership by question: "Headlines for science stories are often misleading."

	non-reader	1 day/week	2 days/week	3 days/week	4 days/week	5 days/week	6 days/week	7 days/week	Total
No Answer	1 (9%)	1 (2%)		1 (3%)				1 (1%)	4 (0.9%)
Agree	9 (82%)	35 (75%)	19 (68%)	23 (77%)	20 (84%)	53 (93%)	79 (84%)	151 (87%)	389 (83.7%)
Neutral	1 (9%)	9 (19%)	9 (32%)	5 (17%)	3 (12%)	3 (5%)	12 (13%)	16 (9%)	58 (12.5%)
Disagree		2 (4%)		1 (3%)	1 (4%)	1 (2%)	3 (3%)	6 (3%)	14 (3.0%)
Total	11 (2.4%)	47 (10.1%)	28 (6.0%)	30 (6.5%)	24 (5.2%)	57 (12.3%)	94 (20.2%)	174 (37.4%)	465 (100%)

Chi-square = 32.59, p <.05

Table 43. Frequency of readership by question: "The press should be more critical of science (asking such questions as "What are the stakes?" "Who pays?")

	non-reader	1 day/week	2 days/week	3 days/week	4 days/week	5 days/week	6 days/week	7 days/week	Total
No Answer				1 (3.3%)		1 (1.8%)	2 (2.2%)	4 (2.3%)	8 (1.7%)
Agree	8 (72.7%)	24 (51.1%)	16 (57.1%)	12 (40%)	12 (50%)	28 (49.1%)	40 (43.0%)	99 (56.9%)	239 (51.5%)
Neutral	3 (27.3%)	14 (29.8%)	8 (28.6%)	10 (33.3%)	9 (37.5%)	19 (33.3%)	32 (34.4%)	43 (24.7%)	138 (29.7%)
Disagree		9 (19.1%)	4 (14.3%)	7 (23.2%)	3 (12.5%)	9 (15.8%)	19 (20.4%)	28 (16.1%)	79 (17.0%)
Total	11 (2.4%)	47 (10.1%)	28 (6.0%)	30 (6.5%)	24 (5.2%)	57 (12.3%)	93 (20.0%)	174 (37.5%)	464 (100%)

Chi-square = 13.99, p >.10

Table 44. Frequency of readership by question: "Reporters are too disrespectful of scientists."

	non-reader	1 day/week	2 days/week	3 days/week	4 days/week	5 days/week	6 days/week	7 days/week	Total
No Answer			1 (3.6%)	1 (3.3%)			2 (2.1%)	2 (1.1%)	6 (1.3%)
Agree		10 (21.3%)	9 (32.1%)	4 (13.3%)	3 (12.5%)	15 (26.3%)	13 (13.8%)	28 (16.1%)	82 (17.6%)
Neutral	8 (72.7%)	26 (55.3%)	15 (53.6%)	20 (66.7%)	13 (54.2%)	22 (38.3%)	32 (34.4%)	96 (55.2%)	249 (53.5%)
Disagree	3 (27.3%)	11 (23.4%)	3 (10.7%)	5 (16.7%)	8 (33.3%)	20 (35.1%)	30 (31.9%)	48 (27.6%)	128 (27.5%)
Total	11 (2.4%)	47 (10.1%)	28 (6.0%)	30 (6.5%)	24 (5.2%)	57 (12.3%)	94 (20.2%)	174 (37.4%)	465 (100%)

Chi-square = 25.02, p >.10

Table 45. Frequency of readership by question: "Reporters are generally fair to science."

	non-reader	1 day/week	2 days/week	3 days/week	4 days/week	5 days/week	6 days/week	7 days/week	Total
No Answer		1 (2.1%)		1 (3.3%)			1 (1.1%)	1 (.6%)	4 (.9%)
Agree	3 (27.3%)	16 (34.0%)	11 (39.3%)	7 (23.3%)	11 (45.8%)	23 (40.4%)	36 (38.3%)	65 (37.4%)	172 (37.0%)
Neutral	5 (45.5%)	19 (40.4%)	6 (21.4%)	15 (50.0%)	4 (16.7%)	17 (29.8%)	32 (34.0%)	62 (35.6%)	160 (35.6%)
Disagree	3 (27.3%)	11 (23.4%)	11 (39.3%)	7 (23.3%)	9 (37.5%)	17 (29.8%)	25 (26.6%)	46 (26.4%)	129 (27.7%)
Total	11 (2.4%)	47 (10.1%)	28 (6.0%)	30 (6.5%)	24 (5.2%)	57 (12.3%)	94 (20.2%)	174 (37.4%)	465 (100%)

Chi-square = 16.87, p >.10

Table 46. Occupation of respondents contacted by the media and opinion of experience

	Physical/Life Science	Applied Science	Other	Total
Ext. Good	1 (1.5%)	1 (2.4%)		2 (1.8%)
Very Good	13 (19.7%)	10 (24.4%)	1 (16.7%)	24 (21.2%)
Average	38 (57.6%)	23 (56.1%)	3 (50%)	64 (56.7%)
Very Poor	9 (13.6%)	5 (12.3%)	2 (33.3%)	16 (14.2%)
Ext. Poor	5 (7.6%)	2 (4.8%)		7 (6.1%)
Total	66	41	6	113

Chi-square = 60.71, p <.01

Table 47. Education of respondents contacted by the media and opinion of experience

	BS/BA	BS/BA+	MS/MA	MS+	Ph.D.	Postdoc.	Total
Ext. Good		1 (14.3%)				1 (4%)	2
Very Good			1 (5.9%)	3 (50%)	13 (22.8%)	7 (28%)	24
Average	1 (100%)	3 (42.9%)	12 (70.6%)	1 (16.6%)	34 (60%)	13 (52%)	64
Very Poor		2 (28.5%)	4 (23.5%)	1 (16.6%)	7 (12.2%)	2 (8%)	16
Ext. Poor		1 (14.3%)		1 (16.6%)	3 (5%)	2 (8%)	7
Total	1	7	17	6	57	25	113

Chi-square = 115.86, p <.01

Table 48. Age of respondents contacted by the media and opinion of experience

Age / Opinion	20-29	30-39	40-49	50-59	60+	Total
Ext. good	1 (33.3%)			1 (3.2%)		2 (1.8%)
Very good			10 (20.4%)	8 (25.8%)	6 (35.2%)	24 (21.2%)
Average	1 (33.3%)	10 (77%)	27 (55.1%)	18 (58.1%)	8 (47.1%)	64 (56.6%)
Very poor	1 (33.3%)	2 (15%)	9 (18.4%)	2 (6.4%)	2 (11.8%)	16 (14.2%)
Ext. poor		1 (8%)	3 (6.1%)	2 (6.5%)	1 (5.9%)	7 (6.1%)
Total	3	13	49	31	17	113

Chi-square = 40.59, p <.05

APPENDIX C

POSITIVE ASPECTS OF NEWSPAPER COVERAGE OF SCIENCE

- Present science in a positive light, 15;
- Good coverage of medical news, 12;
- Educates the public about science, 12;
- Coverage of science helps generate support for the funding of science, 12;
- Recognize the importance of scientific news, 10.
- Coverage is increasing, 10;
- Some out-of-town papers have good coverage, 9;
- Gives pros and cons of scientific issues, 7;
- Entertaining and interesting, 7;
- Speedy, 7;
- Oak Ridger is good, 6;
- Good astrophysical and space coverage, 6;
- Timely topics, 5;
- Good coverage of cold fusion story, 5;
- Some reporters try to do a good job, 5;
- Balanced coverage across the sciences, 5;
- Good graphics, 4;
- Raises issues, 4;

- Newspapers provide better details than radio and television, 4;
- Accessibility of the press, 4;
- Good coverage of science at Martin Marietta Energy Systems, 3;
- Some newspapers use reporters trained in science, 3;
- Terse, 3;
- Presents science news relevant to people's lives, 3;
- Frank Munger, 3;
- Gives scientists an audience, 3;
- Good coverage of arms and defense industry, 2;
- Is energetic, 2;
- Good support for Department of Energy, 1;
- Good coverage of computing, 1;
- Good coverage of nuclear fusion, 1;
- Good coverage of safety, 1;
- Forces scientist to think of things he might not have thought of, 1;
- Dispels fears about science, 1;
- Eases the way for commercial application of science, 1;
- Promotes competition, 1;
- Helps attract jobs to the area, 1;

NEGATIVE ASPECTS OF NEWSPAPER COVERAGE OF SCIENCE

- Implies cure-alls and instant answers, 22;
- Headlines are bad, 22;
- Do not follow up, 20;
- Miseducate and mislead, 19;
- Only tell one side of the story, 19;
- Is anti-nuclear, 17;
- Jumps the gun - cold fusion is an example, 15;
- Emphasizes the extremes, 14;
- Does not cover basic research well, 13;
- Oversimplifies, 12;
- Often misses the point, 11;
- Tries to "sell papers," 10;
- Uses adversarial approach, 10;
- Scientists use the media for self-promotion, 9;
- Not all issues have two sides, 9;
- Reporters do not understand the science, 9;
- Focuses too much on the political aspects, 8;
- Does not allow review before publication, 7;
- Quotations are often out of context, 6;
- Focuses on disagreement, 5;

- Does not cover the benefits of science, 5;
- Involves the public in technical debate where they do not belong, 4;
- Reporters do not ask the right questions, 3;
- Editors are to blame, 3;
- Quotes the famous, not necessarily the expert, 3;
- Portrays science as exact when it is not, 2;
- Seeks scapegoats, 2;
- Does not distinguish science from pseudoscience, 1;
- Follows science fads, 1;
- Frank Munger, 1;
- Promotes stereotypes, 1;

SUGGESTIONS FOR IMPROVING RELATIONSHIP

- Reporters should be accurate, 18;
- Reporters should avoid jumping to conclusions, 14;
- Scientists should explain in layman's terms, 12;
- Scientists should have training on the First Amendment, 12;
- Devote more space to science, 11;
- The press should give pros and cons, 11;
- Scientists should initiate contact with reporters when they (scientists) have something to report, 10;

- Both should avoid the adversarial approach, 9;
- The scientists should be allowed to write stories, 9;
- Avoid sensationalism, 7;
- Reporters should try to understand the scientists, 7;
- The scientists and reporters should spend more time together, 6;
- Reporters should check technical details, 6;
- Newspapers should not deal with fringe elements, 5;
- The press should educate, 5;
- Both should foster greater mutual understanding, 4;
- The press should improve headlines, 3;
- Make the editors responsible, 3;
- Reporters should understand the philosophy of science, 3;
- Have scientists on the newspaper staff or on call, 2;
- Scientists should respect the reporters, 2;
- Reporters should guard against misquoting their sources, 2;
- Corporate controls should be removed so that the scientists have more freedom to speak, 2;
- Reporters should be more skeptical of science, 2;
- Internships would give reporters the opportunity to work with scientists, 1;
- Newspapers should be more positive, 1;

- The press should be more pro-science, 1;
- Scientists should use public relations representatives, 1;
- There should be a list of science sources that newspapers could use for checking details, 1;
- There should be more coverage of on-going science, as opposed to major emphasis on breakthroughs and innovations, 1.
- Newspapers should have more human interest stories about the scientists, 1.

APPENDIX D

SOURCES OF SCIENCE NEWS

ACI
ACM JUST Journal of Nuclear Materials
AGU Transactions
AICHE Journal
AISC Journal
AMSAT Journal
APS Bulletins
ASCE Journal
ASHRAE Journal
ASM
ASME "Manufacturing Engineering"
ASSE Publications
Accounts of Chemical Research
Aerospace Weekly
Agronomy
Air and Waste Management Association Journal
American Association of Cost Engineering magazine
American Meteorological Society Bulletin
American Physical Society Bulletins
American Scientist
American Society of Landscape Architects
American Society of Testing Materials
Applied Physics Letters
Architect's Journal
Astronomy
Audubon
Aviation Week
BYTE
Beyond 2000 (TV)
Bioscience
Biochemical Journal
Biomass and Bioenergy
Biotech Journal
Building Construction
C Users Journal
CNN (TV)
Chemical Engineering
Chemical Engineering News
Chemical Engineering Progress
Chemical Processing
Chemical abstracts
Chemical and Engineering News
Civil Engineering Magazine

Computer-Aided Engineering
Construction Management Magazine
Consulting and Spec Engineering
Control Electrical Engineering Times
Control Engineer
Cost Engineering (AACE)
Current Contents
Design Magazine
Discover Magazine
Discovery Channel (TV)
EC & M
EOS (AGU)
EPA News
Ecology
Elect. Construction & M
Elect. World
Electronic Design
Electronic mail/BBS
Electronics Design
Engineering Management Journal
Engineering News Record
Environmental Progress
Environmental Science and Technology
FASEB Journal
Fusion Power Report
Fusion Technology
Geotimes
Government Computing
Haz/Mat World
Hazard Prevention News
Health Physics Journal
Health Physics newsletter
Heating, Piping, Air Conditioning
Heavy and Highway Construction
Human Genome News
Hydraulics Pneumatics Magazine
Industrial Engineering
Industrial Chemical Annual
Insight
Inst. Electrical Engineering Spectrum
Inventions and Technology Magazine
Journal of Applied Physics
Journal of Catalysis
Journal of Chemical Physics
Journal of Geophysical Research
Journal of Physical Chemistry
Journal of Wildlife Management

Knoxville News-Sentinel
Laser Focus
MAC
Martin Marietta Energy Systems News
MRS Bulletin
Machine Design
Macromolecules
Manufacturing Systems
Material Research Bulletin
Measurement and Control
Mechanical Engineering
Modern Steel Construction
NASA technical briefs
National Public Radio
New York Times
National Geographic
National News (TV)
Nature
News Scientist
Newsweek
Nucleonics Week
Nuclear News
Oak Ridger
Omni
Public Broadcasting System
PC Magazine
PC Week
PC World
Personal Engineering and Instrumentation News
Physical Review
Physical Review Letters
Physics Journal
Physics Today
Planning Journal
Plant Engineer
Pollution Engineering
Popular Mechanics
Popular Science
Powder and Bulk Engineering
Power Magazine
Power Transmission Design
Proceedings from professional organizations
Processing
Production
Professional Estimator
Professional Safety
Professional Surveyor

QST
R & D Magazine
RSI
Radiation Research
Radio Communication Report
Radio Electronics
Reliability and Risk Assessment Journal
Roads and Bridges Magazine
Society of Manufacturing Engineering magazine
Science News
Science
Scientific American
Scripta Metallurgica
Seminars/conventions
Separations Science and Technology
Sky and Telescope
Smithsonian
Society Meetings
Sound and Vibration
Surface Science
TV News
Technology Review
Texas Transportation Researcher
Textbooks
The Auk
The Journal Science
The Scientist
Time
UBC
UNIX World
US News and World Report
Vendor literature/catalogs
Wall Street Journal
Water Environment and Technology

VITA

When Sally Ann Guthrie earned the bachelor of science degree in journalism from the University of Tennessee more years ago than she will admit, little did she know what wonderful adventures were ahead. The excitement of being a police reporter and feature writer in Sarasota, Florida, came right after graduation. Later she reaped the rewards and faced the challenges of teaching English in Knoxville area high schools. She spent some time at State Technical Institute learning engineering graphics and engineering technology. Technical illustration and drafting provided an outlet for artistic skills when she started working with engineering companies. Finally, she became a technical writer at Martin Marietta Energy Systems in Oak Ridge. There she combines writing skills with her technical background. Now, she is eagerly awaiting the new adventures to follow the master of science degree.