Scientific Literacy, Ignorance Studies: Reflections from *Science Communication*

[Editor's note: Welcome to the new column "Views Afield", which focuses on journals and journal articles likely to interest science editors. For more information, please see page 119.]

Science Communication (Sage Publications Inc) "is an international, interdisciplinary social science journal that examines the nature of expertise, the diffusion of knowledge, and the communication of science and technology among professionals and to the public" as explored by persons from all disciplines and organizations. The journal began in 1978 under the title Knowledge: Creation, Diffusion, and Utilization and changed to the current title in 1994. In the issue introducing the name change, the editor, Marcel LaFollette, discussed the scope of the field of science communication, which ranged from concerns about communication among scientists to the problems in communicating science information to the public. About the latter, LaFollette stated that it is "neither an experiment nor a technical procedure. It is a responsibility."

In the September 1998 issue (vol 20, nr 1), the journal celebrated its 20th anniversary and the passing of the editorship from Dr LaFollette to Carol Rogers with a collection of articles by its editorial board members on their views of the most interesting question related to science communication. Again, Dr LaFollette provided an excellent summary of the various views. She noted that the dominant topic was a knowledge gap between the source of information and those it is aimed at. The problem is no longer distribution of information, but access to and understanding of it. Furthermore, research in science communication has previously focused primarily on content more than process. What is still lacking is a workable theoretical framework. Two of the articles from the special 20th anniversary issue are summarized below.

Paisley WJ. Scientific literacy and the competition for public attention and understanding. Sci Commun 1998;20: 70-80.

Literacy, which was originally linked to knowledge about language, is usually discussed in terms of shortcomings and connotes an obligation to learn rather than an activity to enjoy. Concern about scientific literacy was born in the post-Sputnik era from programs aimed at moving students toward scientific careers and at increasing public support for science to keep abreast of the Russians. C P Snow's "Two Cultures" lecture nurtured that concern.

Today, concern about scientific literacy leads to regular "scoldings" of particular groups for not ensuring that others are "studying, teaching, attending, planning, or communicating hard enough." Some maintain, however, that a truly scientifically literate public is impossible to attain, because unless knowledge is used regularly, it will not persist. Thus, at any time, only the roughly 5% of the public who are continuously using science can ever be considered scientifically literate.

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Inasmuch as support for a scientific or public program depends less on its own merits than on public support, the claim of specialized groups on the public's attention and understanding has manifested in the proliferation of "topical literacies": At least 45 types have been proposed in US journals and popular media from 1960 to 1995, from A (aesthetic, agricultural, and artistic literacies) to U (urban) and V (video and visual). The most common references to literacy as documented from Magazine Index Online are, in descending order, computer literacy (1123 citations), cultural (268), and scientific (241).

Three types of scientific literacy have been proposed: knowledge of science content, of scientific method, and of the impact of science on society. The greatest problem in basing scientific literacy on the "quasi-encyclopedic" approach of science content is that "even scientists who agree with the approach do not agree with the specific items" that should be known. Pointing to a link between pseudoscience and scientific illiteracy, a proponent of the methods approach thinks that understanding of scientific methods will give the public the ability to recognize pseudoscience and to understand the foundation of scientific debates that may arise about public-policy issues. The third type of literacy, the impact-on-society approach, is based on the programs in science, technology, and society at universities: The public can know all the ways that science affects society without knowing the content or the method of science.

The author describes two other types of literacy. One occurs spontaneously when nonscientific persons become extremely knowledgeable about some issue that affects their lives, for example, health. In these cases, which can be considered "situational scientific literacy" as opposed to the "normative" literacy of the 3 other types, laypersons make discoveries that experts missed or did not consider. The author also identifies an "episodic literacy", which comes from repeated exposure to particular topics in the mainstream media due to controversy, such as HIV; due to accidents, such as Chernobyl; or due to a dramatic finding, such as cold fusion. Thus, scientific literacy may occur in unexpected forms that go unrecognized by those who think it is lacking when it is measured in conventional ways.

Stocking HS. On drawing attention to ignorance. Sci Commun 1998;20: 165-178.

Forms of ignorance have lately come under study in fields ranging from mathematics (fuzzy set theory) to psychology (cognitive bias). Ignorance is now also becoming a subject of concern in science studies. The culture of science since Galileo and Descartes

has fostered pride in knowledge. According to science historian J R Ravetz, however, "at a time when 'ignorance swamps knowledge in the face of global problems that are created by science-based technology', this pride in scientific knowledge and ignorance of ignorance is deeply dangerous." Studies to explore the unknown and unknowable are growing in number, and many argue that ignorance is socially constructed. Indeed, scholars in "ignorance studies" have begun to make the case that scientific ignorance, much more than scientific knowledge, may be subject to social processes.

Some scholars with interests in public science, for example, have argued that scientists' claims of what is irrelevant, biased, inaccurate, incomplete, absent, or uncertain are modified by corporations and special-interest groups and by journalists to express, advance, or protect particular interests. In a study of how different news magazines reported on the same new medical finding, it was found that short news stories contained few warnings about the limitations of the research. This was not simply because there was less space for such information, however. Journalists presumed that readers judged the significance of a news story from its length: A short story would be considered less important by readers and have less influence on them. Therefore, journalists included fewer warnings on the limitations of the research in short stories than in long stories.

Other work has begun to explore "ignorance arrangements", social arrangements whereby individuals or groups intentionally deprive themselves or others of scientific knowledge. For example, through interviews, cleanup workers at the Chernobyl accident site revealed that they did not seek out risk information about their work, because they thought that would signal mistrust in those who were making arrangements to protect them. Thus, scientific illiteracy in some circumstances may be functional, not simply a cognitive deficit or the result of poor public schooling, as it is often portrayed to be.

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In other research, a historian of science has suggested that what does not get studied by scientists may be due to social forces, such as the absence or neglect of interested parties, lack of funding for particular fields of study, or censorship. For example, the emphasis on biologic mechanisms of cancer obscures social causes of cancer that society might otherwise work to prevent. Also, cancer prevention would require changes not only in research priorities, but also in personal lifestyle and the business sector, which may lead to "structural apathies".

One subject needing work in ignorance studies is the cataloging of different ways that scientists refer to the unknown—such ignorance-laden terms as "knowledge gaps", "rejected knowledge", "lost knowledge", "surprises", "anomalies", "mysteries", "uncertainties", "errors", "ambiguities", and "confusion"—and the social contexts for the use of various terms.

Unfortunately, those who work in ignorance studies have encountered social pressures to speak in conventional terms of "uncertainty" rather than "ignorance", even when what is meant is the more limited sense of outright absence of knowledge. One author was pressured by his publisher to add the word "uncertainty" to the title of his book about ignorance (Ignorance and Uncertainty: Emerging Paradigms). Founders of the Curriculum on Medical Ignorance at the University of Arizona encountered similar resistance.

One of the most valuable effects of studying ignorance of all sorts may be a fostering of humility. In art, a technique for learning how to draw involves looking at the spaces around an object in order to draw it. In the same way, thinking about what we do not know about something may improve the act of knowing.