

**Keeping Up with Science
May be Difficult But
Understanding It is Even More So!**

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Almost everyone in our society is aware of scientific change--and with good reason.

For research scientists, the importance of keeping up with new developments in their own or related fields is self-evident. But those who govern and those who control the purse-strings for research must keep up in a different way. They must be alert to the changes in research fronts. The military has an obvious and similar interest in technological changes, as do those involved in industry and manufacturing. The academic community must maintain an awareness of the latest scientific developments in order to be able to teach effectively. Often academics need to conduct research at the frontiers of knowledge just to remain effective teachers. Even artists--musicians, writers, visual artists--are finding it increasingly important to be cognizant of scientific developments. And the continuing fascination with the in-

fluence of science on the future among the educated, literate public is demonstrated by the popularity of science fiction.

Unfortunately, keeping up with scientific progress is not as easy as keeping up with developments in, say, politics. A huge network of reporters, editors, analysts and commentators is engaged in the single-minded pursuit of political news. Politics is covered each day in cap-sulized doses in newspapers and on radio and television. For those who want a deeper understanding of political developments, there are hundreds of magazines, journals, and books. The abundance of political commentary and analysis makes it relatively easy to keep up with daily events. Ironically, this abundance makes it all the more difficult to trace the historical development and structure of political changes. Political scientists have been among those who have welcomed new developments like the *Social Sciences Citation Index*[®] (*SSCI*[®]).

Understanding the current history and structure of scientific change is quite different. The mass media cover science only superficially, and even then are almost wholly obsessed with the dramatic and spectacular. Books, magazines, and secondary scientific publications (like *Science News* or *Medical World News*) keep laymen and professionals informed about scientific progress, but their content is merely an echo--less detailed, less clear, and less timely--of specific original research findings. Once in a while, these secondary sources will present a fresh juxtaposition of facts, an original analysis, or an insight into the process of discovery--but this is science journalism at its best, not at its usual quality.

For about a century past scientists themselves have relied on published papers to understand developments in their fields. Along with personal contacts and letters, the papers published in primary journals form the most complete, most authoritative report of scientific progress.

But there is no huge organization, no network, no syndicate of analysts and reporters of original research findings. The "news" is

reported by the newsmakers themselves, in their own words. Journal editors and referees maintain standards of quality and style.

In order to understand and detect the rapidly changing research fronts, analysts must depend to a large extent on the scientific literature itself.

As we've indicated many times, the structure of this literature is reflected by the references to earlier papers contained in each new report. These are regularly collected in the *Science Citation Index*. Using both manual and machine methods, it is possible to identify areas of research activity through citation analysis. In particular, it is possible to visually map the changing relationships between various scientific specialties.

The reprinted paper which follows, "Understanding Science by Analysing its Literature," was first presented to the Institute of Information Scientists in 1975 in London.¹ In it, my colleague A.E. Cawkell discusses the early warning methods for detecting the research fronts of science we have developed at ISI®. We expect this work to culminate soon in an *ISI Atlas of Science*.

1. Cawkell A. E. Understanding science by analysing its literature. *Information Scientist* 10(1):3-10, March 1976. Reprinted in *Current Contents*® (CC®) No. 33, 16 August 1976, p. 7-13.