

# Agony and Ecstasy of the Internet: Experiences of an Information Scientist Qua Publisher

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## Abstract

**Over three years ago, the bi-weekly newspaper The Scientist® was mounted on the NSFnet and has been available worldwide on the Internet ever since. Recently it has migrated to the World Wide Web. The two systems will be compared with specific examples. Future Internet success will depend upon innovative display and visualization techniques as well as real time access and highly specific search engines. Using the Internet for selective dissemination of information will be discussed by comparing searches on**

**Alta Vista to searches by CD-ROM. Future current awareness and SDI systems (Current Contents®, Research Alert®) will be linked to electronic journal libraries. Cited reference searching, a variant of hyper-text searching, will be discussed with respect to SCI® and Web crawlers.**

When I learned that my good friend Ahmed Helal was retiring, I could not fail to respond to his invitation to participate in this 19th International Essen Symposium. So I was glad that it was acceptable to this library-oriented group to speak about my experiences as a publisher on the Internet. You might say that I am the co-publisher with the University of Pennsylvania where the database resides. Ann Okerson, Steve Harnad, and others have forecast that would be the ultimate fate of scholarly publication but that kind of migration from private to university publishing has been quite limited.<sup>1, 2</sup>

The Internet is a mixed-bag. It produces considerable frustration but also occasional exhilaration. It suffers not only from information overload and redundancy but also lacks real time access. The delay you encounter in accessing most URLs is somewhere between bearable and intolerable. As I'll demonstrate later, until we have real time access to the URLs identified by Web crawlers such as Alta Vista, Lycos, etc., frustration will prevail.

### **Gopher as KWIC Index**

Last year at an American Chemical Society meeting, I described the electronic version of *The Scientist*, the newspaper that I've published for 10 years. When we started that Gopher file three years ago on NSFnet, it was kind of gee-whiz - isn't that wonderful? By the time we launched our Web site at the University of Pennsylvania over two years later, the Gopher file at AT&T already left something to be desired including its strict chronological order.

## GOPHER MENU

Keyword Search of The Scientist Newsletter  
QUESTIONNAIRE

-ls  
README  
help1

index-the-scientist  
jobs-the-scientist-960318  
jobs-the-scientist-960401  
jobs-the-scientist-960415  
jobs-the-scientist-960429  
jobs-the-scientist-960513  
jobs-the-scientist-960527

---

ls-ls  
overview  
the-scientist-900108  
the-scientist-960108  
the-scientist-960122  
the-scientist-960205  
the-scientist-960219  
the-scientist-960304  
the-scientist-960318  
the-scientist-960401  
the-scientist-960415  
the-scientist-960429  
the-scientist-960513  
the-scientist-960527  
the-scientist-960610  
the-scientist-960624  
the-scientist-960708  
the-scientist-960722  
the-scientist-960819  
the-scientist-960902

**Slide 1: Gopher Menu for *The Scientist***



Here for example is a sample WAIS search on combinatorial chemistry.

**gopher://ds0.internic.net:70/7waissrc:/pub/the-sc**

## Gopher Search

This is a searchable Gopher index. Use the search function of your browser to enter search terms. Enter search keywords: COMBINATORIAL CHEMISTRY

## Gopher Menu

.TI: The First Combinatorial Library AU: Jack D. Keene DT: August 19, 19  
.TI : CELL BIOLOGY TY : RESEARCH (HOT PAPERS) PG : 16 S.A.  
.TI: CATALYTIC ANTIBODIES NEED TO BE FASTER, MORE PLentiful AU: DIANA MORGAN  
.TI: CONTENTS DT: April 2, 1990 PG: 2 (The Scientist  
.TI: Combinatorial Chemistry DT: July 8, 1996 PG: 14 TY: Research (Hot P  
.TI: CHEMISTRY AU: RON MAGOLDA Medical Products Department E.I. Du Pont de N  
.TI : MOLECULAR BIOLOGY TY : RESEARCH (HOT PAPERS) PG : 17  
.TI : CONTENTS DT : May 13, 1996 PG : 3  
.TI: Managed Care And Research AU: Gary L. Steinman DT: August 19, 1996  
.TI: PEOPLE BRIEFS DT: June 11, 1990 PG: 27 TY: PROFESSION (The Scientist  
.TI: BIOCHEMISTRY DT: September 3, 1990 PG: 17 TY: RESEARCH (The Scientis  
.TI : CONTENTS PG : 3 (The Scientist, Vol.10 #14 pg.3  
.TI: CONTENTS DT: August 19, 1996 PG: 3  
.TI: Life Sciences AU: SIMON SILVER Department of Microbiology & Immunology  
.TI: PATENT OVERLOAD IN MONOCLONAL ANTIBODIES AU: ELIZABETH PERINISI DT: Ap  
.TI : MOLECULAR BIOLOGY DT : January 21, 1991 PG : 14 TY : RESEARCH (HOT PAP  
.TI: Combinatorial Libraries: A New Fast Track To Monoclonals AU: RICKI LEWIS  
.TI: LANDMARK IN IMMUNOTOXINS, 1980-1989: SELECTED PAPERS DT: April 2, 1990 P  
.TI : Despite Recent Layoffs, Biotechnology Industry Is Far From Dead  
.TI: Landmark Biotech Research Began With A Seaside Stroll AU: RICKI LEWIS  
.TI : Drug, Biotech Firms Beginning To Embrace Combinatorial Chemistry  
.TI: Eight Researchers Accept The National Medal Of Science For 1996 A  
.TI: Three Companies Bet Their Futures On Catalytic Antibodies: P  
.TI: Changing Disciplines Can Offer Personal And Professional Satisfaction  
.TI: Genetic Engineers Vitalize Monoclonal Antibody Arms British and U.S. sci  
.TI : Starting Up: What's Attractive To Biotech Investors? Industry observa

### Slide 3: Gopher Search via WAIS on "combinatorial chemistry" on top of slide and menu of results on bottom

The presentation for a keyword search is reminiscent of the KWIC indexes developed by Herb Ohlman at Systems Development Corporation (SDC) and Peter Luhn of IBM in the late 1950s. You would think that AT&T could come up with something a little more sophisticated than a KWIC index display.

In the next series of slides, we have the corresponding displays for the Web site, which does provide reverse chronological order.

## THE SCIENTIST®

The Newspaper For The Life Sciences Professional

- August 1996**  
[August 19, 1996](#) Volume 10, No. 16
- July 1996**  
[July 22, 1996](#) Volume 10, No. 15  
[July 8, 1996](#) Volume 10, No. 14
- June 1996**  
[June 24, 1996](#) Volume 10, No. 13  
[June 10, 1996](#) Volume 10, No. 12
- May 1996**  
[May 27, 1996](#) Volume 10, No. 11  
[May 13, 1996](#) Volume 10, No. 10
- April 1996**  
[April 29, 1996](#) Volume 10, No. 9  
[April 15, 1996](#) Volume 10, No. 8  
[April 1, 1996](#) Volume 10, No. 7
- March 1996**  
[March 18, 1996](#) Volume 10, No. 6  
[March 4, 1996](#) Volume 10, No. 5
- February 1996**  
[February 19, 1996](#) Volume 10, No. 4  
[February 5, 1996](#) Volume 10, No. 3
- January 1996**  
[January 22, 1996](#) Volume 10, No. 2  
[January 8, 1996](#) Volume 10, No. 1
- December 1995**  
[December 11, 1995](#) Volume 9, No. 24
- November 1995**  
[November 27, 1995](#) Volume 9, No. 23  
[November 13, 1995](#) Volume 9, No. 22
- October 1995**  
[October 30, 1995](#) Volume 9, No. 21  
[October 16, 1995](#) Volume 9, No. 20  
[October 2, 1995](#) Volume 9, No. 19
- September 1995**  
[September 18, 1995](#) Volume 9, No. 18  
[September 4, 1995](#) Volume 9, No. 17
- August 1995**  
[August 21, 1995](#) Volume 9, No. 16
- July 1995**  
[July 24, 1995](#) Volume 9, No. 15  
[July 10, 1995](#) Volume 9, No. 14
- June 1995**  
[June 26, 1995](#) Volume 9, No. 13  
[June 12, 1995](#) Volume 9, No. 12

[Gopher version](#) of The Scientist, containing issues from 1992 to the present.

### Slide 4: Web Contents, June 1995 to August 19, 1996

# THE SCIENTIST®

the Newsletter For The Life Sciences Professional

## Sections

Web Contents  
Web Search  
Gopher Version  
Gopher Search

News  
Opinion & Letters  
Research  
Hot Papers  
Profession  
Tools  
New Products  
Advertisers  
Notebook  
Cartoons  
Clarifications  
Crossword Puzzles  
Jobs/Meetings/Symp

Web Statistics

Current issue Volume 11, No. 1, January 6, 1997

## Stories in this Issue

- Kessler Resignation Sparks Concern About Future Of FDA
- Few Natural Science Classes Affected By Teaching Assistant Strike In California
- Biotechnology Turns To Ancient Remedies In Quest For Sources Of New Therapies
- Controversial Group Marks Quarter-Century Of Fighting For NIH Women Scientists' Rights
- Amid War, Scientific Publication Survives In Former Yugoslav Republics
- Scientists Can Advance Research By Joining With Patient-Advocacy Groups
- Despite Changes In Benefit Plans, Retiring Scientists Still Have Options
- Harold Kroto Contemplates Applications Of Nobel-Winning Fullerenes
- Geneticist Frederick W. Alt and microbiologist Guillermo Taccioli discuss a DNA-dependent protein kinase enzyme, a component of the DNA double-strand break repair system
- Neurologist Julie A. Bennett-Desmelik reports on the topology of the glutamate receptor.
- Liquid Handling Equipment Evolves To Suit Large-Scale Applications

## Notebook:

- More Reviews of Peer Review
  - Tenure Lives For Now
  - EASEB: NIH Deserves More
  - Scientist At the Helm
  - A Piece of Mars For Sale
  - Why Menstruate
  - Bacteria-Fighting Buckyballs
  - "Grande Dame" Dies
- Jobs, Symposia, Grants
- ... And more ...

Slide 5: Listing of "stories in this issue" for August 19, 1996

VOLUME 10, No:16

# THE SCIENTIST®

The Newspaper for The Life Sciences Professional

August 19, 1996

## NEWS

### **Merger Mania Hits Med Schools, Prompting Scientists' Anxieties**

Author: Myrna E. Watanabe, pp. 1, 4-5

**WILL THE AX FALL?** When hospitals merge to compete in a changing health care market, job security and research funding become major issues, particularly in the case of the proposed merger between Mount Sinai Medical Center and New York University Medical Center, which also plan to combine their medical schools.

### **Decision In Imanishi-Kari Appeal Spurs Call For Changes In System**

Author: Billy Goodman, pp. 1,6-7

**APPEAL AFTERMATH:** As the dust settles after Thereza Imanishi-Kari's exoneration in a decade-long scientific misconduct case, observers are calling for an overhaul of the system for dealing with such charges.

### **Reports Give Boost To Xenotransplantation As Researchers Wait For Federal Guidelines**

Author: Robert Finn, pp. 1,8

**GREEN LIGHTS FOR XENOTRANSPLANTS:** Two independent reports say that research on the transfer of organs and tissues from animals to humans should continue since the potential benefits of the procedure outweigh the risks.

### **Veterinary Medicine Begins To See Effects of Biotechnology Boom**

Author: Kathryn S. Brown, pp. 1, 9

**OF DNA AND DOGS:** Scientists realize career alternatives to human-health research as biotechnology makes inroads in the animal health market

### **Eight Researchers Accept The National Medal of Science for 1996**

Author: Thomas W. Durso, pp. 3, 10

**SCIENCE MEDALISTS:** The National Medal of Science was awarded to eight researchers, including two life scientists, last month.

## OPINION & COMMENTARY

### **Animal-Rights Movement's "Bible" Contains Distorted Revelations**

Author: Adrian R. Morrison, pp. 11

**DEBUNKING THE 'BIBLE':** False allegations about mistreatment of animals in Animal Liberation, the 1975 book by Australian ethicist Peter Singer that inspired several anti-research organizations to take action, is still affecting science and government policy, contends Adrian R. Morrison, a professor of behavioral neuroscience at the University of Pennsylvania.

**Slide 6 and 7: Complete contents page for August 19, 1996 including short abstracts**



**An Old Proposal For A New Profession: Scientific Reviewing**

Author: Eugene Garfield, pp. 12.

Reviewing, a demanding task that presents a noble challenge, should be encouraged as much as research by the scientific community, according to Eugene Garfield.

**LETTERS**"Managed Care And Research." by Gary L. Steinman;"The First Combinatorial Library." by Jack D. Keenc;"Legal Consulting." by Ronald D. Hood**RESEARCH****Psychoneuroimmunology Finds Acceptance As Science Adds Evidence**

Author: Steven Benowitz, pp. 14-15.

MATTERS OF THE MIND: Psychoneuroimmunology, the study of the interaction between the brain and the immune system, is gaining acceptance in the mainstream medical world as evidence mounts that the mind does indeed affect overall health.

**HOT PAPERS**Clinical researcher Edward M. Connor details his study reporting that the drug zidovudine helped reduce maternal-infant transmission of HIV-1 by almost 70 percent; Biophysicist Mark Gray-Keller explains the change in intracellular calcium that accompanies the light response in isolated rod photoreceptor cells.**PROFESSION****How To Spur Scientific Revolution: Amass Copious Data, Keep It Simple**

Author: Karen Hopkin, pp. 18

DEPOSING THE DOGMA DU JOUR: That crazy theory that explains all your research findings may not fit today's scientific models, but that doesn't mean it's not valid; researchers who have struggled to gain acceptance and funding for their ideas urge persistence.

**TOOLS & TECHNOLOGY****Scientific Publishers Increasing Electronic Information Offerings**

Author: Robert Finn, pp. 19-20

ELECTRONIC SCIENCE: Scientific publishers are offering more products-including journals, databases, bibliographic abstracts, and full-text articles-on CD-ROM and the World Wide Web.

**Slide 6 and 7: Complete contents page for August 19, 1996 including short abstracts**

## THE SCIENTIST®

### Result of Search

Search for: **combinatorial chemistry**

#### Pages with Number of References

1. [Drug, Biotech Firms Beginning To Embrace](#) [22]
2. [Combinatorial Chemistry](#) [4]
3. [Immunological Applications Top List Of](#) [3]
4. [CELL BIOCHEMISTRY](#) [3]
5. [New Technologies And Approaches Spur Industry Interest](#) [3]
6. [Opinion \(Letters\): The First Combinatorial Library](#) [3]
7. [Industry Investors Show Increased Interest In](#) [3]
8. [Liquid-Handling Equipment Evolves To Suit Large-Scale Applications](#) [2]
9. ['Merger Mania' Among Drug Firms Raises Concern About](#) [2]
10. [Biotechnology Turns To Ancient Remedies In Quest For Sources Of New Therapies](#) [1]
11. [Changing Disciplines Can Offer Personal And Professional Satisfaction](#) [1]
12. [User-Friendly Software Makes Molecular](#) [1]
13. [Pharmaceutical And Biotech Firms Taking On](#) [1]
14. [Molecular Parasitology: A Decade Of Detailed Study](#) [1]
15. [Today's Peptide Chemists Face A Dizzying Array Of](#) [1]

## THE SCIENTIST®

### Result of Search

Search for: **molecular modeling**

#### Pages with Number of References

1. [User-Friendly Software Makes Molecular](#) [13]
2. [Molecular Modeling](#) [3]
3. [Pure And Simple: Chromatography A Vital Tool In](#) [1]
4. [Naval Lab 'Experimentalist' Honored With Bower Award](#) [1]

### Slide 8: Searches on Web site on "combinatorial chemistry" (top) and "molecular modeling" (bottom)

Three years ago, I was glad to be able to do a search at all, so a KWIC display was acceptable. Now even this more attractive looking display [provided through the University of Arizona's Glimpse search engine at Penn], while an improvement, still leaves room for improvement when there are more than three or four hits.

Most search engines are unforgiving. Once you create a file, special programming is needed to include in the display information like the date of issue, unless you are prepared to re-index every document.

To illustrate how you proceed from the first stage of a search to the next, I've done a search on "technology transfer."

## THE SCIENTIST®

The Newspaper For The Life Sciences Professional

### Result of Search

Search for: **technology transfer**

#### Pages with Number of References

1. University Technology Offices Focus Effort On Overcoming 950612 [11]
2. USING THE INTERNET FOR TECHNOLOGY TRANSFER 950612 [9]
3. Michigan State University Patent Dispute Illustrates Changes 951030 [8]
4. Research Parks Forming Strategies To Adapt To End 960708 [4]
5. The Road To University Technology Licensing Is Littered 950918 [3]
6. Observers See Ominous Trend In '96 Science Budget 951016 [3]
7. NIH 'Reinventing' An Expanding SBIR Program 961028 [2]
8. President Clinton's Science Policies Draw Cheers, Jeers From Observers 961014 [2]
9. Clinton Administration Seeks New Model For Applied Research 950724 [2]
10. Limited Access To cDNA Database Has Drug 941212 [2]
11. Gerontologist's Provocative Question -- Docs NIA Spend 960219 [1]
12. Merger Mania Hits Med Schools, Prompting Scientists' 960819 [1]
13. Industry Investors Show Increased Interest In 960401 [1]
14. Legal Tussle Over cDNA Libraries May Stall Gene Sequence 951002 [1]
15. THE LEADERS OF SCIENCE : THE READERS OF THE SCIENTIST 951113 [1]
16. National Labs' Future In Jeopardy 951127 [1]
17. OPINION - Exclusion Of Diversity And Creativity Impedes Scientific Innovation 951127 [1]
18. MBA Programs Expand Career Prospects For Cross-Trained 950626 [1]
19. Genome Investigator Craig Venter Reflects On Turbulent Past 950724 [1]
20. Environmental Scientists Hail New Forest Service Chief 940110 [1]

**Slide 9: Search done on "technology transfer"**

In the next slide, I've called up hit #2 "Using the Internet for Technology Transfer".

## USING THE INTERNET FOR TECHNOLOGY TRANSFER

*Author: Lee Katterman*

Several universities have turned to the Internet to help promote the inventions of their faculty. In some cases, universities have provided searching capability, permitting the Internet browser to display nonproprietary descriptions of inventions available for licensing. Here are the URLs (Universal Resource Locators, also known as "addresses") that turned up during some recent "Net-surfing."

1. Indiana University Technology Transfer Office at <http://www.indiana.edu/~techtran/index.html>
2. University of Michigan Technology Management Office at <http://www.tmo.umich.edu/>
3. Michigan State University Division of Engineering Research at <http://web.egr.msu.edu/~gleasonb/index.htm>
4. Massachusetts Institute of Technology Technology Licensing Office at <http://web.mit.edu:1962/tiscrve.mit.edu/9000/24442.html>
5. Ohio University Virtual Technology Transfer Office at <http://ra.cs.ohiou.edu/gopher/non-academic/tto/vlohome.html>
6. Penn State Research and Technology Transfer Organization at <http://infoserv.rtonet.psu.edu/rtto.html>
7. Rutgers University Office of Corporate Liaison and Technology Transfer at <http://info.rutgers.edu/Services/Corporate/corporate/>
8. Stanford University Office of Technology Licensing at <http://www-leland.stanford.edu/group/OTL/aboutotl.html>
9. State University of New York, Stony Brook Office of Technology Transfer at <http://www.research.sunysb.edu/research/techxfer.html>
10. University of Washington Office of Technology Transfer at <http://cary.u.washington.edu/ott/ott.html>
11. United States Patent and Trademark Office at <http://www.uspto.gov/>
12. A list of URLs of patent information sources collected by Ohio University at <http://ra.cs.ohiou.edu/gopher/non-academic/tto/patents.html>
13. A list of URLs of university, government, and private organizations involved in technology transfer at <http://cary.u.washington.edu/ott/TechTransfer.html>

(The Scientist, Vol:9, #12, pg.10, June 12, 1995)  
(Copyright, The Scientist, Inc.)

WE WELCOME YOUR OPINION. IF YOU WOULD LIKE TO COMMENT ON THIS STORY, PLEASE WRITE TO US AT EITHER ONE OF THE FOLLOWING ADDRESSES:

[garfield@aurora.cis.upenn.edu](mailto:garfield@aurora.cis.upenn.edu)  
[71764.2561@compuserve.com](mailto:71764.2561@compuserve.com)

The Scientist,  
3600 Market Street, Suite 450, Philadelphia, PA 19104  
U.S.A.

**Slide 10: Article by Lee Katterman shows 13 hot-linked connections**

First entry (Hit #1) is for Indiana University's "Technology Transfer Office." That takes us to their home page (Slide 11).

# Technology Transfer at Indiana University

501 N. Morton Street, Suite 111  
Bloomington, IN 47404

Telephone 812/855-7842 Facsimile 812/855-3757

**Technology Transfer Office**

**Technologies**

**Newsletter**

**ATAIN, Inc. Alliance**

**BioPharm Internet Resources**

**Slide 11: Home page of Indiana University's Technology Transfer Office**

As I said, if you plan ahead your webmaster can create more attractive and useful displays. Here, for example, is the result of a search on "Hot Papers." This was one of the categories shown previously on our contents page in Slide 5. The dates have been included as separate headings in the redesign.

**THE SCIENTIST®**

The Newspaper for The Life Sciences Professional

**Hot Papers****August 19, 1996**

- Clinical researcher Edward M. Connor details his study reporting that the drug zidovudine helped reduce maternal-infant transmission of HIV-1 by almost 70 percent.
- Biophysicist Mark Gray-Keller explains the change in intracellular calcium that accompanies the light response in isolated rod photoreceptor cells.

**July 22, 1996**

- Geneticists James R. Burke and Jeffery M. Vance explain their search for the chromosomal mutation that causes the neurodegenerative disorder known as Haw River Syndrome
- Molecular biologist Andreas Batzer describes the binding sites for the proteins Grb2 and Shc on the epidermal growth factor receptor

**July 8, 1996**

- Geneticist Kenneth H. Buetow explains one of the first attempts to integrate PCR and RFLP markers into human genome maps
- Chemist Mark A. Gallop discusses applications of combinatorial chemistry in drug discovery

**June 24, 1996**

- Cellular biochemist Thomas Söllner reports on a protein-receptor complex required for targeting specificity to vesicular transport
- Cell biologist Lewis C. Cantley discusses development of optimum motifs for several Src homology region 2 domains of enzymes

**June 10, 1996**

- Geneticist James M. Wilson discusses how to circumvent immune reactions when testing gene therapy for cystic fibrosis
- Pathologist Richard J. Cote describes antigen removal, a new technique to enhance tissue staining that makes immunohistochemistry results easier to reproduce.

**May 27, 1996**

- Telomere Biology: Cell biologist and neuroscientist Jerry Shay reports on association of human telomerase activity with immortal cells and cancer.
- Plant Disease Resistance: Agricultural biotech researcher Bernard Vernooij discusses salicylic acid's role on the development of systemic resistance in plants.

**May 13, 1996**

- Medical researcher Richard Steinman reports on the p21(WAF1) protein's role in triggering cell differentiation
- Cancer researchers Jeffrey Bluestone and Craig B. Thompson discuss the role of CTLA-4, an immune system protein

**Slide 12: Hot Papers**

When we agreed to put *The Scientist* on the NSFnet, we were frequently asked whether it wasn't dangerous to its survival as a subscription service. There is nothing in our experience that would confirm that expectation. As a strictly ASCII file, I was confident that few subscribers to the print edition would give up the pleasure and value of the printed edition. Three years later that situation has not changed and I still cannot really tell you yet how many people "read" *The Scientist* in electronic form. We receive statistics each month on the number of searches, etc. But one FTP could be serving the needs of every scientist in New Zealand. We've asked librarians or computer managers who FTP files if they have any idea how many people use or read *The Scientist* in its electronic version, but most really can't say. Everything is expressed in terms of searches and hits.

I had hoped that it would be possible to use the Internet in a pro-active way so as to improve the dissemination of *The Scientist's* articles to all relevant readers of listservers, bulletin boards, etc. So far it has proven to be too time consuming to attempt to identify all relevant bulletin boards for each new story or to correspond with the individual bulletin board monitors or editors. The rules of etiquette on the original Internet prohibited us from trying to send out a wide swath broadcast of the contents page of each issue. Even the now commercialized Internet has not changed the fact that unsolicited mail offends most scientists, particularly as information overload has increased. Of course, individual readers, knowing of an article that would interest colleagues, can go up on our Web or Gopher sites to transmit that article.

Having *The Scientist* at my fingertips has saved us considerable time in responding to requests for information. This is a mixed blessing. Students worldwide seem to think we are authorities on any subject we have covered in a news story. Recently, someone asked for advice on how to obtain an MBA as part of his plan to switch from microbiology to management because we had published an article last year on cross-training in career development. We often receive desperate requests for advice on medical problems.

A recent experience with *The Scientist* editorial staff illustrates the cultural change that is involved in going from traditional indexes to electronic access. We have produced manual author and keyword indexes to *The Scientist* since its inception. These printed indexes cover 1986 to 1995. It is no longer urgent for us to produce this index on a fully current basis since we can access *The Scientist* by keyword on our Web site. When we

planned this year's budget in November we excluded the cost of the manual index. Then in May someone asked when it would be updated. The advantages of the printed index were cited. But when I asked how long it took to access the original stories they seemed perplexed. I pointed out that you had to take into account the time required to locate the article in the library. Long before you've found the issue in the library, you can display the article on the screen and if necessary print a copy. (Slide 13: *The Scientist* Subject Index - Highlight "technology transfer")<sup>10</sup>

In the time that remains, I would like to comment on my experiences with Web crawlers such as Alta Vista and make some random comments on Alta Vista, Dialog, and some other search methods. For example, a search on DialIndex for information on "technology transfer" produces a list of databases containing various items on that subject. (Slide 14: DialIndex search on "technology transfer")<sup>10</sup>

When you do a search on Alta Vista, you produce a list of URLs which may range from a computer host to a specific abstract. In a recent talk to NFAIS, Roger Summit pointed out that Alta Vista had 23 million "records" while Dialog gave you access to 334 million, half in science.<sup>3</sup>

I mentioned earlier the problems of delivering information to the editors of Internet bulletin boards. These editors could use one or more crawlers to find out what articles have appeared in *The Scientist* that concern the interests of their invisible colleagues. Of course, this means they have to create term profiles that will anticipate the varieties of natural and scientific language implied by their specialties. But they will be directed to the full text of articles, since each article is a separate URL. With Dialog they will be directed mainly to titles and abstracts within particular databases.

### **Electronic versus Printed Outputs**

We have been hearing for quite some time how the Internet is going to displace the printed word. It used to be called the paperless society. But we are still consuming enormous quantities of paper to print our e-mail and Internet output. I for one can't sit for hours reading a screen. Even if I could, the portability of printouts is necessary for my mobile existence. I frequently see people in planes and trains using portable PCs, but somehow they never seem to be reading. We have a long way to go before the printed page is displaced. Are you ready to replace reading your morning paper with electronic access? The same reasoning may not apply to reading scientific



or scholarly journals. Some of them are so large that they defy easy browsing.

### **Future of SDI Systems**

I continue to be an avid user of ISI's SDI system. The ISI® *Research Alert*® (formerly ASCA) has now been around for over 30 years<sup>4</sup>. It was the first commercially available SDI system. But for over 20 years it was unable to survive without the financial support of the *SCI*® database. Scientifically it was a success and continues to serve the needs especially of applied scientists. But for basic researchers it still has to be combined with scanning of journal contents pages. In fact, the success of *Current Contents* was, and still is, primarily due to the inability of most researchers to define their reading needs precisely. If they knew exactly what they needed, would research be necessary?

The quantity of information published today is much greater than it was 40 years ago when ISI started. Yet I can honestly say that 50% of what I read would not turn up in any ordinary keyword search. But that might change as the full-text revolution matures. ISI's *Research Alert* can now be delivered over the Internet, thereby making it more timely and also susceptible to further electronic manipulation. I've just begun testing this out myself since it includes abstracts as well as titles. (Slide 15: ISI Research Alert report)<sup>10</sup>

### **Cited Reference Searching**

When I was more active in research, I literally scanned the contents of seven editions of *Current Contents*. As time passed, I increasingly relied upon the unique ability of cited reference searching via *Research Alert* to support my reading needs. Cited reference searching is simply a variant of hypersearching. It will be an integral part of the fully electronic journal world of the future. For the moment, however, it is not practical to use the Internet to find all articles which have cited your work, or some specific paper, book, or author - at least not without considerable effort.

A group at the University of Southampton in the UK is also developing what it calls linking databases.<sup>5</sup> Making journals and the *SCI*® and other databases transparent to each other in the near future is an increasingly realistic expectation. STN has already done this to some extent. ISI is

developing *SCI* Intranet capability which will eventually cover the entire file from 1945 to the present. ISI has already announced the use of the Internet for *Current Contents* and *Research Alert*. (Slide 16: Distributed Link Service in UK)<sup>10</sup>

Using today's Web crawlers to search for cited references is rather frustrating and time consuming.

When I did a simple search for my name on Alta Vista, using advanced query mode, the first 10 entries retrieved are quite relevant. And so is the 11th. But then you are directed to the Eugene, Oregon, Chamber of Commerce located on Garfield Street! (Slide 17: Alta Vista search on "Eugene Garfield" using the advanced query)<sup>10</sup>

Then at the bottom of the list there is a home page for the Cantrell family whose members include Eugene and Garfield Cantrell. Since then this adjacency problem can be reduced by putting my name in quotes, but what happens when we have to search references which simply cite "E. Garfield"? This search proved to be almost useless unless you are interested in Garfield the cat! (Slide 18: Index of Persons - Cantrell)<sup>10</sup>

Once again, let me stress the importance of display or visualization. With Alta Vista and other crawlers, you must hyperlink to each URL in turn to find out why you were directed to that URL.

In a typical citation search using an *SCI* CD-ROM, here is what you see initially for a cited reference search. Note that I do not have to specify the full first name but simply the initials, which is standard practice in science journals. (Slide 19: *SCI* Search on Eugene Garfield from 96 Jan-May Disc; Slide 20: *SCI* Search Results (List of Citing Papers))<sup>10</sup>

These could have included abstracts. Whether article titles or abstracts, these are printed as a group or one at a time.

In the next slide (Slide 21: Sample Long Citing Record)<sup>10</sup> I've printed one full citing record, which includes title, authors, addresses, abstract, and list of cited references.

In the near future you will be able to do these *SCI* searches via the ISI Intranet. And it will also be possible via the ISI Electronic Library to access the electronic version of journals. That project has been widely announced and briefly described as providing "users with immediate desktop access to the tables-of-contents, bibliographic data, and abstracts of the approximately 1,350 prestigious journals indexed in *Current Contents/Life Sci-*

ences, as well as to the full images of those journals in the system for which publishers have given permission. ISI has partnered with a number of players like IBM in order to expedite this initiative.

### Visualization

Visualization has become a hot new area of information science thanks to people like Ed Tufte<sup>6</sup> and Jock Mackinlay, Ramana Rao, and Stuart Card at Xerox Research Center in Palo Alto<sup>7</sup>. (Slide 22)<sup>10</sup>

In this slide you can see how citation networks are visualized in their butterfly model of the citing and cited pathways to a key paper. Unfortunately, I can't fully demonstrate how this three dimensional portrayal works. It moves around in 3-D like you move molecular models.

For decades information scientists and historians like Derek Price have aspired to use the *Science Citation Index* database to create an *Atlas of Science*. Henry G. Small visualized a future version of a Citation Index that would also include the ability to do citation context analysis.<sup>8</sup> In this particular version of the SCI, the display of citing papers would not be limited to citing titles and authors but would also include citing sentences or paragraphs. In addition, the information would be displayed in the form of "maps" that reveal intellectual connections. Thus, mini-reviews would be organized automatically but also supplemented with visual mappings of the interrelated links.

The *Atlas of Science* experiment was aborted but this work has been superseded by an electronic version called SciMap. Henry Small's research group provides "SciMap" software to create co-citation maps like those I presented recently at the International Conference on Prostaglandins and Related Compounds in Vienna. (Slide 23: SciMap Example)<sup>10</sup>

And eventually this software will be expanded to generate historiographs from the repertoire of research fronts ISI identifies each year. (Slide 24: Historiograph Example; Slide 25: Co-citation of Core Papers for "Prostaglandins and Inflammation" (RF 76-0869))<sup>10</sup>

In the near future, I have little doubt that searching will be easier, and index displays more friendly and hypersearching within Intranets, at least, will provide real time access.

Whether the Internet survives the next stage of its exponential growth has been seriously questioned. Therefore, the separation of the scientific and

scholarly portion of the URL universe from other public information it presently contains may be necessary for its technical survival. In 1963, John W. Senders estimated the escalating information content of the world's libraries.<sup>9</sup> He also discussed the exponential growth of the indexes needed to search these files. It will be interesting to see how long it takes for the Internet to reach exponential saturation unless huge investments are made worldwide to provide real time access to every user.

### References and Annotation

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10. The slides #13 to #25 are not reproducible. A copy of the entire speech (including all slides) can be directly requested from the author by sending an e-mail to [garfield@isinet.com](mailto:garfield@isinet.com).