Reflections of a Scientometrician / Communicator -- From Current Contents to Citationology and Algorithmic Historiography

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China Medical Board Symposium
Beijing
September 23-24, 2002

Dr. Schwarz has asked me to touch on several aspects of my experiences as a science communicator, information scientist, and scientometrician. My presentation today will cover a half dozen topics related to these different roles I have played in the world of information over the past 50 years.

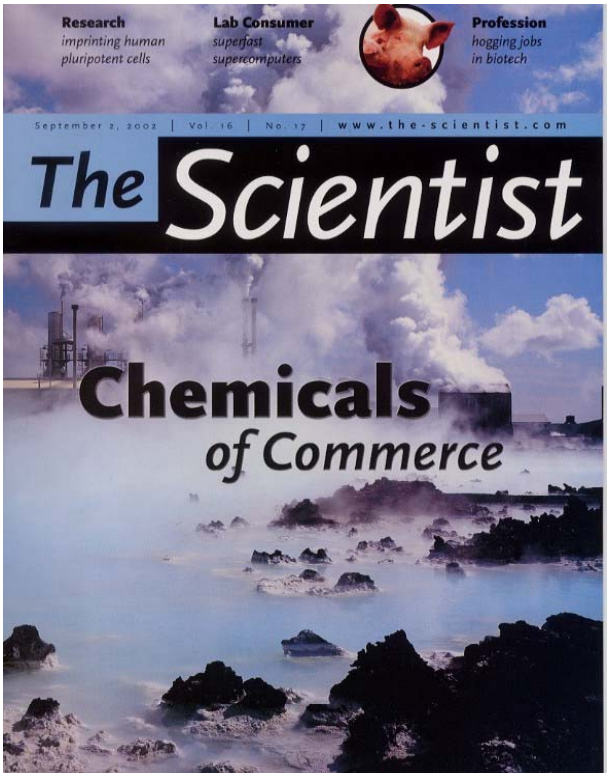
Science Communication

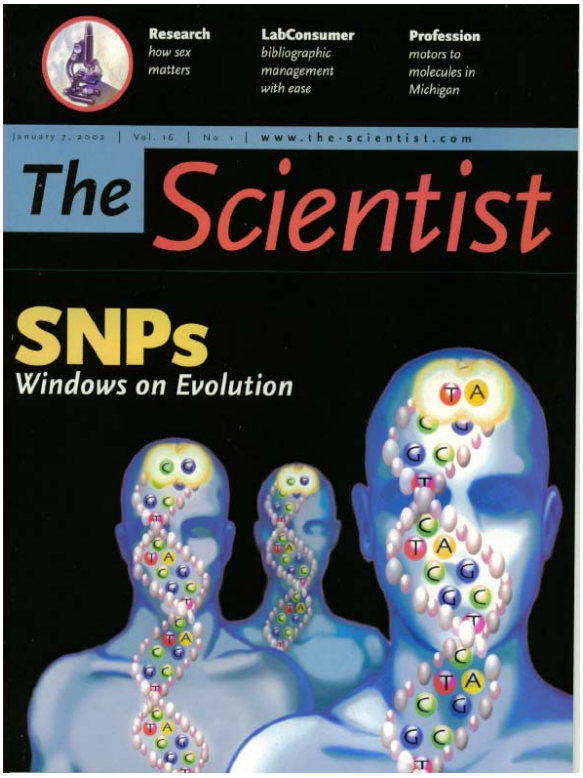
I speak to you first as a publisher and editor of *The* Scientist an internationally-oriented publication for biomedical researchers which was founded 16 years ago. *The Scientist* is very different from the typical medical journal. It started as a monthly newspaper in 1986 in tabloid format.

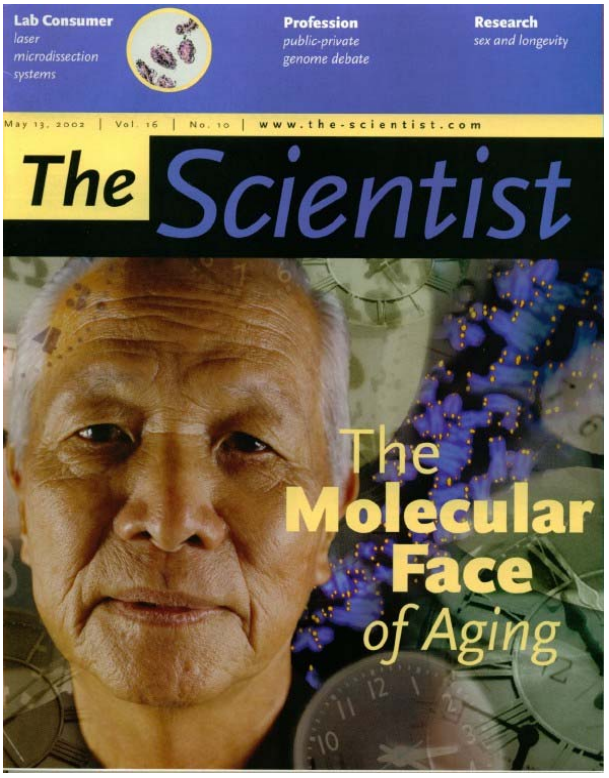
This is the cover of the October 29, 2001 issue which will give you an idea of how it appeared as a tabloid newspaper In January 2002 it was transformed into – a hybrid magazine-news journal.

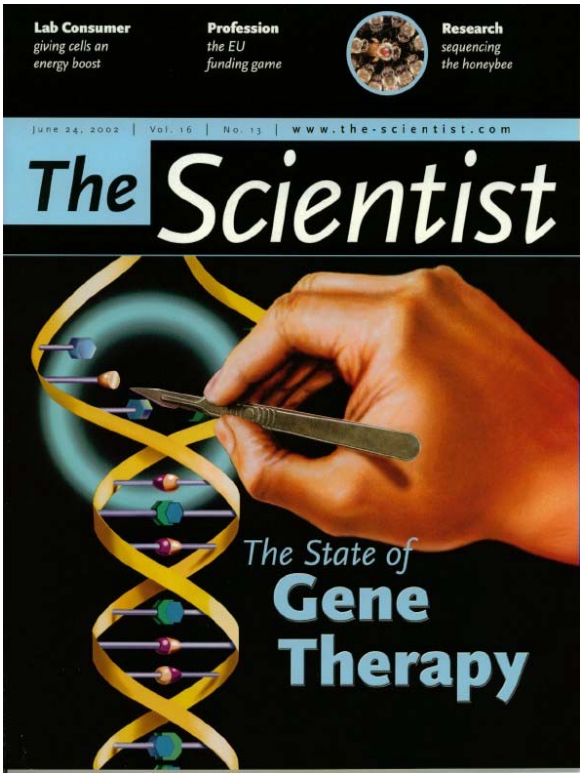
Slide 1.

Here are recent issues illustrating the new magazine format.









Slides 2,3,4,5.

While we adhere to high editorial standards, *The Scientist* is not peer reviewed in the traditional sense since most of our articles are written by science journalists. And, unlike popular newspapers or magazines, we do provide references in our news reports. *The Scientist* is most often compared to *Nature* or *Science.* However, it is distributed free of charge both in print and on the Internet Our printed edition is mainly sent to life scientists and biotech researchers in the United States, Canada, and Western Europe. Over 75,000 copies of each colorful issue is distributed every two weeks -- 24 times each year. Almost half of our readership has a declared interest in molecular biology and medicine. Financial support for *The Scientist* is derived primarily from advertising but next year we intend to expand our paid circulation to libraries and other subscribers who are not qualified to receive it free of charge. Foreign libraries can subscribe to the airmail edition for about $100 per year.

The Scientist is written in a style that is comprehended by most educated people. Therefore it is easily understood by the average clinician or researcher. We have often been asked about translations into foreign languages but that seems to be unnecessary since English has become the universal language of science. However, we would be glad to entertain a proposition from a Chinese publisher interested in producing a Chinese translation both in print or on the World Wide Web.

The Scientist was the first regularly published journal to become available on the WWW. Originally the electronic version was sponsored by the National Science Foundation. Our free email distribution is in excess of 400,000 readers all of whom are registered. Of these readers a surprisingly large number are from the developing world and include about 4,000 users in China.

MISSION STATEMENT OF *THE SCIENTIST*®:
The Scientist is The News Journal for the Life Scientist
It provides research scientists with relevant and timely information and analysis to assist them in making decisions that affect their working lives.

The Scientist provides an open forum for examination and discussion of issues in research, technology, employment, funding, policy and other subjects important to the life scientist.

Slide 6.

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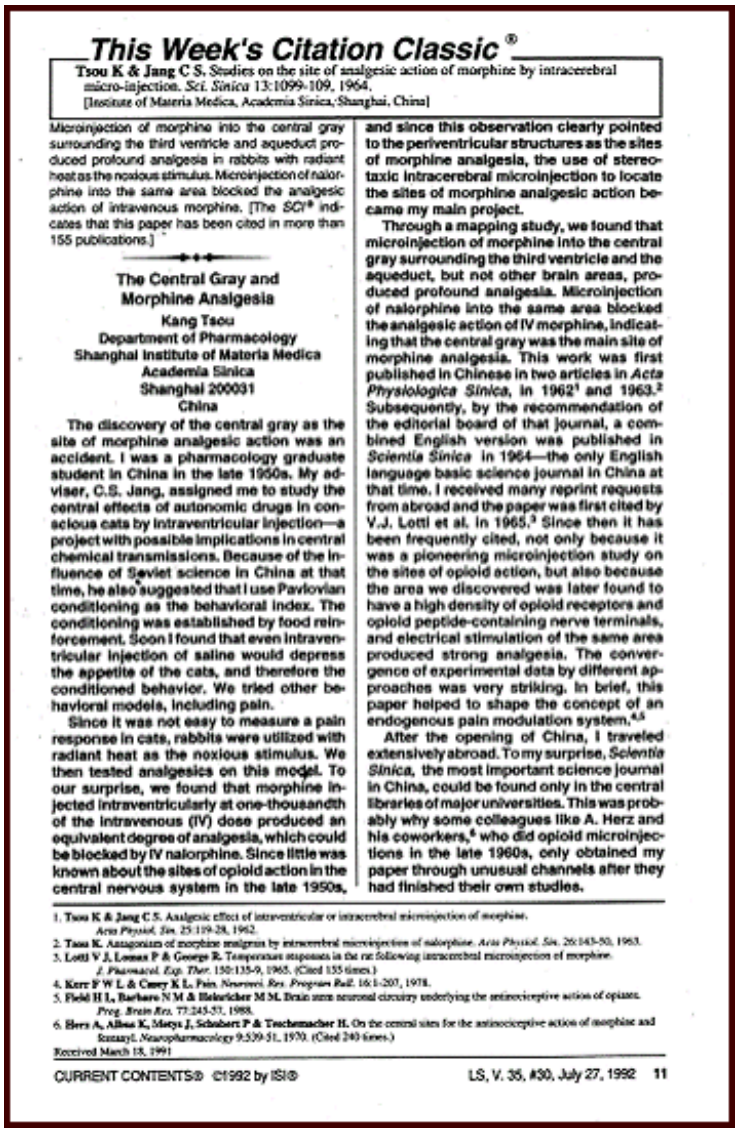
The Scientist presents not only hot science news, but also the human side of science. Therefore, a variety of issues and concerns to the working professional scientist are covered. A staff of full-time and free-lance science journalists report on advances in biomedical research. Due to my own personal background as the inventor of the *Science Citation Index*, we are extremely citation conscious. From the outset we have provided commentaries on hot papers – those that are identified as having been cited from 100 to 200 times during the past year or two.

Most of these papers will go on to become *Citation Classics*.

While most of the news reports are written by journalists, opinion pieces, letters, and commentaries by readers are also published. We welcome such volunteered discussion of scientific and professional issues.

Speaking of *Citation Classics*, you may recall the commentaries published in *Current Contents* about such papers. Here is an example of a paper from Shanghai. The paper was published in *Scientia Sinica* about 40 years ago and is still cited in the current literature.

CITATION CLASSIC AUTHORED BY KANG TSOU, SHANGHAI INSTITUTE OF MATERIA MEDICA



This Week's Citation Classic®

Tsou K & Jang C S. Studies on the site of analgesic action of morphine by intracerebral micro-injection. *Sci. Sinica* 13:1099-109, 1964.
[Institute of Materia Medica, Academia Sinica, Shanghai, China]

Microinjection of morphine into the central gray surrounding the third ventricle and aqueduct produced profound analgesia in rabbits with radiant heat as the noxious stimulus. Microinjection of nalorphine into the same area blocked the analgesic action of intravenous morphine. [The *SCI*® indicates that this paper has been cited in more than 155 publications.]

The Central Gray and Morphine Analgesia

Kang Tsou
Department of Pharmacology
Shanghai Institute of Materia Medica
Academia Sinica
Shanghai 200031
China

The discovery of the central gray as the site of morphine analgesic action was an accident. I was a pharmacology graduate student in China in the late 1950s. My adviser, C.S. Jang, assigned me to study the central effects of autonomic drugs in conscious cats by intraventricular injection—a project with possible implications in central chemical transmissions. Because of the influence of Soviet science in China at that time, he also suggested that I use Pavlovian conditioning as the behavioral index. The conditioning was established by food reinforcement. Soon I found that even intraventricular injection of saline would depress the appetite of the cats, and therefore the conditioned behavior. We tried other behavioral models, including pain.

Since it was not easy to measure a pain response in cats, rabbits were utilized with radiant heat as the noxious stimulus. We then tested analgesics on this model. To our surprise, we found that morphine injected intraventricularly at one-thousandth of the intravenous (IV) dose produced an equivalent degree of analgesia, which could be blocked by IV nalorphine. Since little was known about the sites of opioid action in the central nervous system in the late 1950s, and since this observation clearly pointed to the periventricular structures as the sites of morphine analgesia, the use of stereotaxic intracerebral microinjection to locate the sites of morphine analgesic action became my main project.

Through a mapping study, we found that microinjection of morphine into the central gray surrounding the third ventricle and the aqueduct, but not other brain areas, produced profound analgesia. Microinjection of nalorphine into the same area blocked the analgesic action of IV morphine, indicating that the central gray was the main site of morphine analgesia. This work was first published in Chinese in two articles in *Acta Physiologica Sinica*, in 1962[1] and 1963.[2] Subsequently, by the recommendation of the editorial board of that journal, a combined English version was published in *Scientia Sinica* in 1964—the only English language basic science journal in China at that time. I received many reprint requests from abroad and the paper was first cited by V.J. Lotti et al. in 1965.[3] Since then it has been frequently cited, not only because it was a pioneering microinjection study on the sites of opioid action, but also because the area we discovered was later found to have a high density of opioid receptors and opioid peptide-containing nerve terminals, and electrical stimulation of the same area produced strong analgesia. The convergence of experimental data by different approaches was very striking. In brief, this paper helped to shape the concept of an endogenous pain modulation system.[4,5]

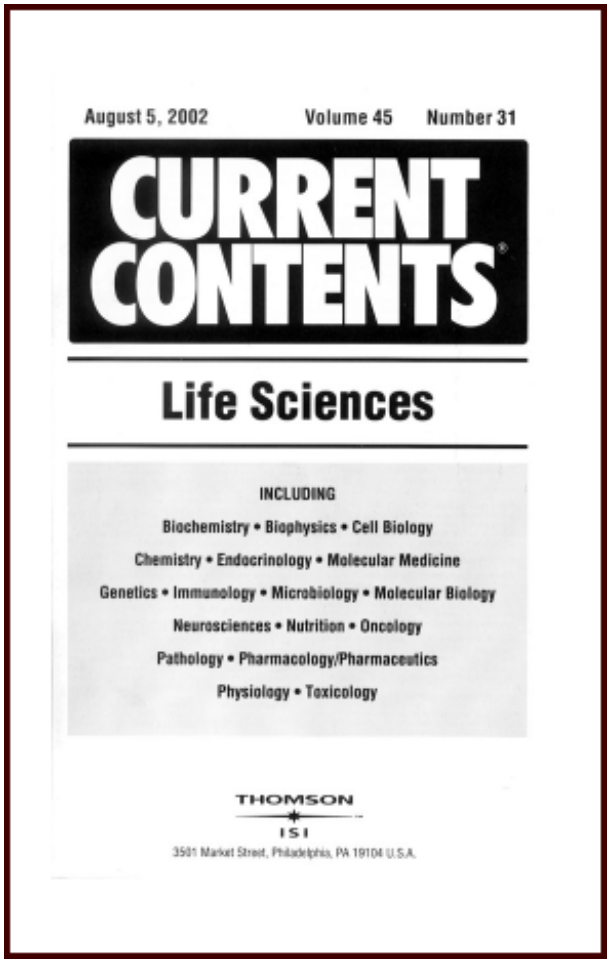
After the opening of China, I traveled extensively abroad. To my surprise, *Scientia Sinica*, the most important science journal in China, could be found only in the central libraries of major universities. This was probably why some colleagues like A. Herz and his coworkers,[6] who did opioid microinjections in the late 1960s, only obtained my paper through unusual channels after they had finished their own studies.

1. **Tsou K & Jang C S.** Analgesic effect of intraventricular or intracerebral microinjection of morphine. *Acta Physiol. Sin.* 25:119-28, 1962.
2. **Tsou K.** Antagonism of morphine analgesia by intracerebral microinjection of nalorphine. *Acta Physiol. Sin.* 26:143-50, 1963.
3. **Lotti V J, Lomax P & George R.** Temperature responses in the rat following intracerebral microinjection of morphine. *J. Pharmacol. Exp. Ther.* 150:135-9, 1965. (Cited 155 times.)
4. **Kerr F W L & Casey K L.** Pain. *Neurosci. Res. Program Bull.* 16:1-207, 1978.
5. **Field H L, Barbaro N M & Heinricher M M.** Brain stem neuronal circuitry underlying the antinociceptive action of opiates. *Prog. Brain Res.* 77:245-57, 1988.
6. **Herz A, Albus K, Metys J, Schubert P & Teschemacher H.** On the central sites for the antinociceptive action of morphine and fentanyl. *Neuropharmacology* 9:539-51, 1970. (Cited 240 times.)

Received March 18, 1991

Slide 7.

Some of you are aware that I was the founder of *Current Contents*. This weekly current awareness publication has continued to operate for over 40 years and provides physicians and researchers with a quick overview of what is published each week.



Slide 8.

AUTHOR ADDRESS DIRECTORY OF *CC/LS*

The CC address directory enables readers to request reprints from authors. *Current Contents* is well known in China. In my visit to China 20 years ago, I saw *Current Contents* in many libraries. Of course, *CC* is now also available in electronic form.

AUTHOR INDEX AND ADDRESS DIRECTORY

The following is an alphabetic list of the names and addresses of all first authors of articles from the contents pages reproduced in this issue. The number opposite the author's name is the *CC* page on which the journal content page *begins*.

Addresses are listed under the first author's name. If the co-author is the person to whom reprint requests should be directed, the co-author's name will appear under the first author's name, preceded by the word "REPRINT".

If an asterisk appears after the page number, it means that no author address was given in the journal. Where the journal does not give an author's address, you may wish to contact the author through the publisher. See the *Publishers Address Directory* at the end of this issue.

Authors with the same last name will often have articles listed in the same issue of *Current Contents*. In using this directory, it is essential to verify that the author found here is the one you want by checking the author's name and article title on the contents page referred to.

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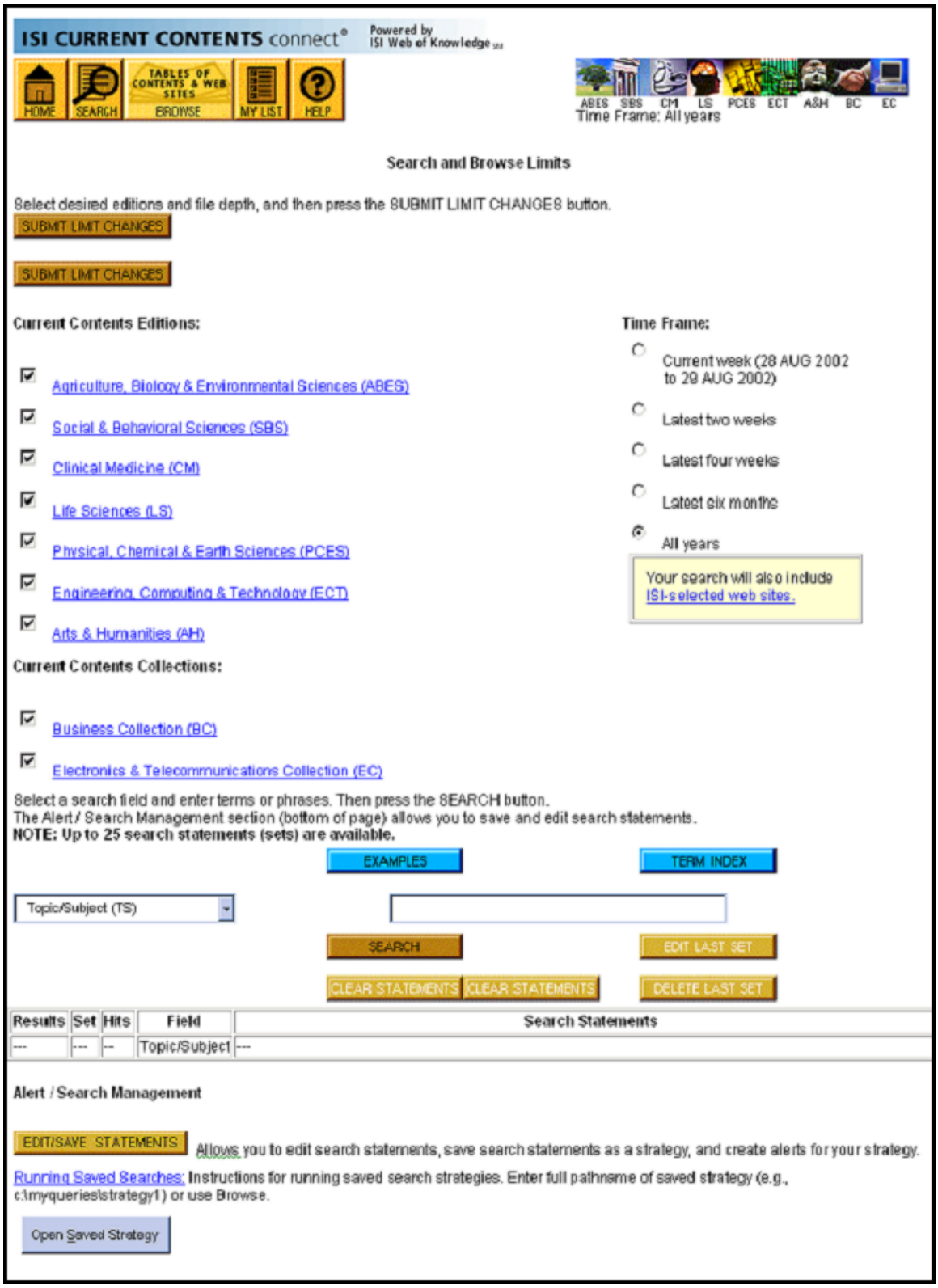

Slide 10.

In addition to listing the contents of thousands of journals, *Current Contents* became well known because of the essays that we published over a 30-year period. More than 1,000 of these essays and my other publications are available free of charge at my website,

www.eugenegarfield.org. *Current Contents* essays were addressed to laboratory and clinical researchers worldwide.

Inevitably, the problem of obtaining financial support for biomedical research became an important theme in *CC* and *The Scientist*. In order to gain support for NIH and larger biomedical budgets it became necessary to get the public to support these efforts. I found it very hard to get scientists themselves to do this.

About a decade ago, first ISI and then *The Scientist* joined Research!America, a non-profit organization that is dedicated to educating the public about the role of NIH and the need to support biomedical research. Through these public outreach efforts, the NIH budget has doubled over the past five years. I am pleased to serve on the Board of Research!America as does Dr. Schwarz and Dr. Anlyan. Through Research!America, we regularly educate the public on the importance of biomedical research in the prevention and treatment of disease but also the development of the U.S. economy. They in turn take this message to their representatives in Congress. Regular polls demonstrate that the public overwhelmingly supports increased funds for biomedical and scientific research. Research!America also has a special task force on prevention research and its international implications.

My interest in proving the economic impact of biomedical research led me to established the Garfield Annual Award for research on the economic impact of medical and health research. Here are the remarks that I made in Philadelphia in July at the presentation of the first Research!America award to Dr. David Meltzer of the University of Chicago:
"I have been asked to say something about the origins of the Research!America economic impact award. My interest in the scholarly impact of research predates the launch of the *Science Citation Index.*® Many people believe the *SCI* was created to study research impact for tenure evaluation or to forecast Nobel Prizes. However, the *SCI*® was invented primarily to improve traditional information retrieval methods. It was inspired by H. G. Wells' book *World Brain*,[1] an encyclopedic database of all human knowledge. Once it was established, the inherent hyperlinked structure of the *SCI* led inevitably to its use for measuring the relative impacts of researchers, journals, institutions, and countries using publication and citation outputs as indicators.

"In the seventies, quite fortuitously, I encountered the work of Julius Comroe and Robert Dripps who worked right here in Philadelphia at the University of Pennsylvania. They traced the impact of basic research on the practice of medicine. Their now classic 1976 article in *Science* on the scientific basis for biomedical science is still worth your attention.[2] The following year Comroe published his "Retrospectroscope – Insights into Medical Discovery,"[3] a remarkable catalog of the complex serendipitous world of basic research and its unpredictable outcomes. In 1979, while preparing a *Current Contents* essay which asked "How Can We Prove the Value of Basic Research?,"[4] I encountered Hugh H. Fudenberg and his pioneering studies in the early seventies on the dollar benefits of research.[5]

"Subsequently, I encountered the work of Professor Ed Mansfield also at Penn. His pioneering work on the role of R&D in economic growth -- demonstrated the high rate of return to society on its investment in basic research.[6] The influence of Fudenberg, Mansfield, and Comroe on my thinking culminated in a major review that I published in *Current Contents* in 1981 on "The Economic Impact of Research and Development."[7]

"I wish these pioneers could have been here to observe the launch of this Award. Hopefully, the Research!America Award will stimulate further studies that remind policy makers in Congress and elsewhere of the social and economic impacts of basic scientific, biomedical, and health research."

I believe this message is equally important in the developing world and must be delivered to economic planners and politicians not just by scientists, but also by lay persons in the population at large who understand that medical research, public health, and education are significant stimulants to the nation's economy.

Current Awareness

My 1955 article in *Science* [8] was the first proposal for a multi-disciplinary index to the scientific literature. I suggested that a *Science Citation Index* was essential for the efficient management of scientific research. In those days it was quite common for unwitting duplication of research to occur[9]. From my experiences as a researcher at the Johns Hopkins Medical Indexing Project from 1951 to 1953, I was inspired to find unique ways to improve the retrieval and dissemination of information. So in 1952, I began an experimental publication covering library science and documentation called *Contents in Advance*. Then in 1955, I began *Current Contents* for management and social sciences and subsequently in 1957 *Current Contents for the Pharmaco-Medical, Chemical, and Life Sciences.*

A few years later, with a grant from the National Institutes of Health (NIH), ISI produced a prototype *Genetics Citation Index*. This in turn led to the first experimental *Science Citation Index* for the 1961 literature. In 1964, *SCI* began as a commercial enterprise.

Personal Alert

Then in 1965, we introduced the first personal alerting service. That system is still in operation. A key element in our SDI system was citation indexing.

In a nutshell, citation indexing permits one to retrieve all papers that have cited a particular paper, author, journal, book, or key word. All of these are useful in overcoming the limitations of natural language and the need to use trained indexers to create subject headings. It is significant that the citation index method is independent of language. The use of bibliographic citations is the universal language of science. While most citations involve the roman alphabet, citations in non-roman alphabets are also quite common. Today we have Citation Indexes in Chinese, Russian, Spanish, and Japanese.

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SEARCH TERM(S): GARFIELD E rauth; SCIENTOMETRICS rwork

KEYWORDS+: SCIENTIFIC CO-AUTHORSHIP; RESEARCH COLLABORATION; MULTIPLE AUTHORSHIP

ABSTRACT: This study examines patterns of authorship in nineteen Egyptian journals of agricultural science. Multiple authorship was found to be the predominant trend in the field and co-authored papers accounted for some 79 percent of the sample. The most common form of multiple authorship involved three people. Considerable variation was found among sub-fields and co-authorship was found to be most common in social-science related agricultural disciplines. The author found no significant differences in patterns of collaboration in the agricultural sciences in Egypt and two the other developing countries for which comparative data was available, India and Pakistan.

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TITLE: Submissions, impact factor, reviewer's recommendations and geographical bias within the peer review system (1997-2002): Focus on Germany (Editorial Material, English)
AUTHOR: Opthof, T; Coronel, R; Janse, MJ
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Slide 11.

At first, the idea of citation indexing and citation analysis were not readily accepted. But by 1975, a core group of 500 libraries subscribed. It took almost 20 years before this methodology was taught in library schools. Even today, there is considerable controversy about its use, not so much for information retrieval but for research evaluation. Each new generation of students must be trained to use this method.

Citationology

I think we can say that today citationology has become a mature science. The use of citation data for research evaluation, especially in science, has become quite pervasive. Bilbiometric studies were conducted even before the *SCI*, but the field of scientometrics followed the official birth of *SCI* in 1964. Then, in 1969, a brilliant Russian philosopher/chemist, V. V. Nalimov, invented the term scientometrics.[10] I was privileged to share his friendship until his death about 5 years ago. Today scientometrics has a worldwide following in the International Society for Scientometrics and informetrics. Indeed, their next conference will be held here in Beijing from August 25-29, 2003, at the Academic Halls of Documentation and Information Center of the Chinese Academy of Sciences. The website for the meeting is http://www.cscd.ac.cn/issi2003/. The journal *Scientometrics* was founded in 1978. However, the much older *Journal of the American Society of Information Science and Technology* also regularly publishes on this topic. The literature on quantitative studies is now quite large; so much so that one of my "retirement" activities has been to provide an electronic alerting service through the SIGMETRICS listserv of the American Society of Information Science and Technology. The listserv is free of charge at: http://listserv.utk.edu/archives/sigmetrics.html .

Time does not permit me to discuss in detail how one uses citation data for evaluation of research performance. One of my most frequently cited papers on this topic is a two-part essay in *Current Contents* on "How to use Citation Analysis for Faculty Evaluations, and When Is It Relevant?"[11] An essential tenet of such statistically-based evaluations is that one cannot ordinarily evaluate a single individual or institution by itself. One should always evaluate a cohort of similar individuals or institutions. There has to be a standard against which one makes a comparison.

Citation Frequencies

CITATION FREQUENCY DISTRIBUTION OF PAPERS IN *SCI*, 1945-88

CITATION FREQUENCY DISTRIBUTION OF PAPERS IN THE SCI*, 1945-1988

A=number of citations
B=number of items receiving that number of citations
C=percent of entire SCI file

A	B	C
>10,000	20	*
5,000-9,999	47	*
4,000-4,999	23	*
3,000-3,999	54	*
2,000-2,999	181	*
1,000-1,999	1,051	*
900-999	325	*
800-899	438	*
700-799	727	*
600-699	1,073	*
500-599	1,828	*
400-499	3,406	0.01
300-399	7,736	0.02
200-299	21,952	0.07
100-199	112,299	0.34
50-99	348,537	1.06
25-49	842,950	2.58
15-24	1,089,731	3.33
10-14	1,207,577	3.69
5-9	2,955,984	9.03
2-4	7,877,213	24.07
1	18,255,577	55.78
TOTAL	32,728,729	100.00

*=less than 0.01 percent of the SCI file, 1945-1988.

Slide 12.

CITATION FREQUENCY DATA FOR 1955-87 *SCI*.

Citation frequency distribution data for 1955-1987 *SCI*®

Times Cited	Number of Items	% of File	
101-over	131,000	.4	1.4%
51-100	300,000	1.0	
26-50	714,000	2.4	
17-25	768,000	2.6	
10-16	1,384,000	4.6	
5-9	2,716,000	9.1	
2-4	7,246,000	24.2	
1	16,668,000	55.7	
TOTALS	29,926,500	100.00%	

Slide 13.

Due to the statistical properties of citations, their relevance will be greatest when dealing with the 20% of the population of scientists and institutions that achieve the highest impact. This is sometimes called the 80-20 rule. A small percentage of scientists or journals receive the lion's share of citations. In 1965, at conference sponsored by the U.S. Office of Naval Research,[12] we demonstrated that Nobel Prize scientists published 6 times the average number of papers and were cited 30-40 times the average. Later, we published a long series of essays in *Current Contents* which demonstrated these facts about scientists *of Nobel Class*. Such scientists are recognized by high citations and eventually Nobel and other prestigious prizes. In my long experience, over 98% of Nobel Prize winners have published one or more Citation Classics. [see my website for this category of essay (http://www.garfield.library.upenn.edu/prize/prize.html). The tradition of analyzing highly-cited authors is also continued by ISI at ISIhighlycited.com – a free website open to the public.

Journal Impact Factors

About 10 years after the launch of the *SCI*, ISI began to publish the annual series called *Journal Citation Reports*. This has now become a widespread tool for journal evaluation. Our original purpose in creating the impact factor was to facilitate comparisons between large and small journals. If size were the only variable considered then 99% of the world's journals would not be considered important. How could you compare a review journal such as the *Annual Reviews of Medicine* which only publishes 35 articles a year, to a large multi-disciplinary journal like *Proceedings of the National Academy of Sciences USA* which publishes thousands of articles each year. Thus, the impact factor normalizes the publication and citation data.

We never imagined that the journal impact factor would become a surrogate for evaluating individual research performance. Using journal impact as a substitute for more exact citation measurement does not always produce the best results. The journal impact factor is a perfectly legitimate way to compare journals and can be used to make rational decisions in libraries about acquiring journals. However, the use of these data for evaluating individuals has to be tempered by the circumstances. This is an extremely controversial subject. Dozens of articles appear each year about the use and abuse of journal impact factors. There are many methods proposed for better normalization.

Nevertheless, it is significant that when the Soros Foundation needed to evaluate which Russian researchers should be given grants, they decided initially to make grants to authors who had published in journals with a minimal level of impact factor. This eliminated most Russian language journals. Similar procedures have been followed in countries like Spain and Italy where having one's papers accepted by an ISI-covered journal with minimal impact is considered significant to funding agencies. Quite often publishing in local vernacular journals is possible because peer review may be non-existent. So it is quite legitimate to use impact factors so long as one understands the purpose and limitations of these methods. But in more sophisticated evaluations precise citation frequency data is obtained. However, the impact factor may help in evaluating a recent paper which ordinarily will not be cited for a few years. The exception, of course, is the hot paper. *The Scientist* regularly reports on such Hot Papers.

Peer Review

Time does not permit me to go into detail on the subject of peer review. The *Journal of the American Medical Association* has regularly published the reports of international congresses on peer review conducted under the leadership of Dr. Drummond Rennie. The most recent, the 4th International Congress on Peer Review, was covered in the June 5, 2002 issue of *JAMA*. Peer review is a subject on which there is a vast literature A pioneering publication in this area is the book by Dr. Stephen Locke[13] the former editor of the *British Medical Journal* who invented the term journalology.

International Versus National Journals

A large percentage of the 20,000 or so scientific journals published are national journals. About 10% of these are truly international journals. English has become the lingua franca of scientific research. The evidence is clear that China has understood this message. Slide 14 shows the language distribution of the *Web of Science* in 2001.

LANGUAGE DISTRIBUTION IN *WEB OF SCIENCE* IN 2001

LANGUAGE DISTRIBUTION IN SCI IN 2001

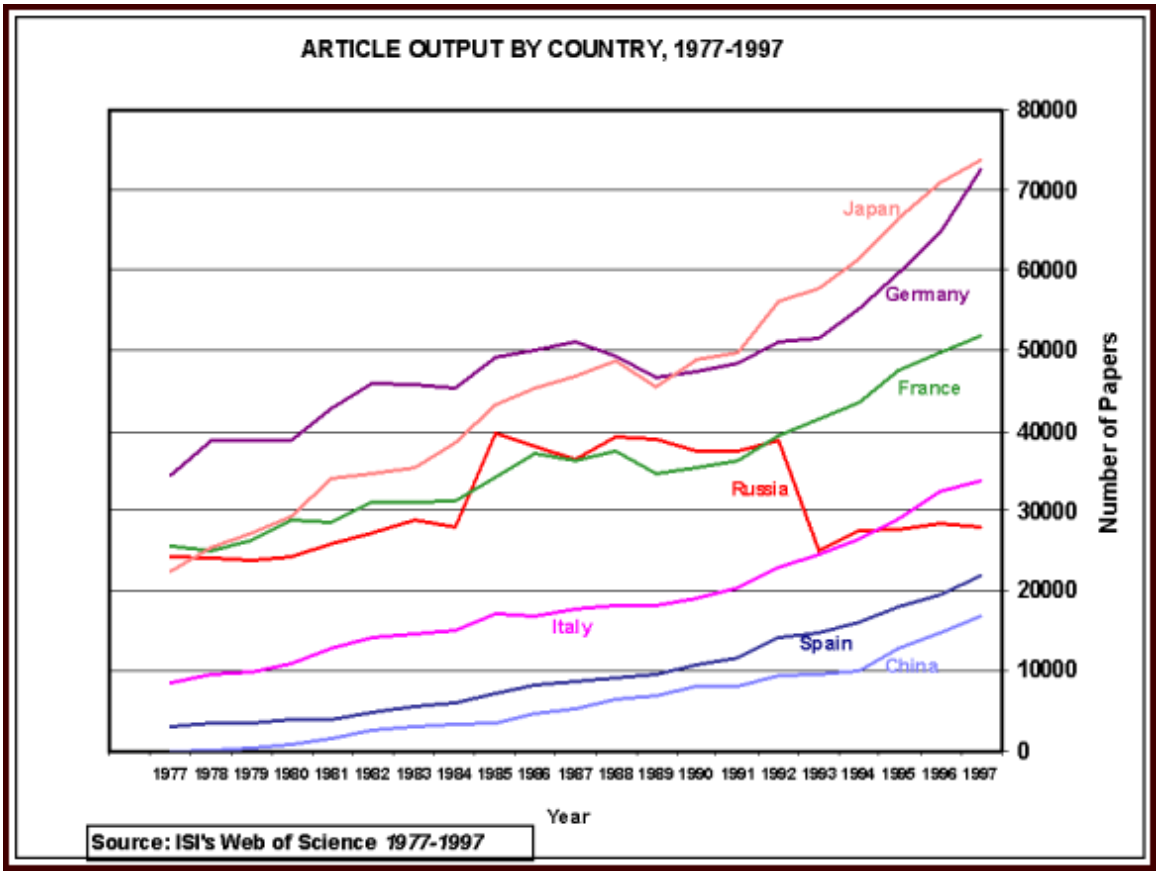
Language	Number of Papers
English	1,109,399
French	21,802
German	20,466
Spanish	6,833
Russian	4,451
Italian	3,992
Japanese	2,615
Portuguese	736
Polish	603
Chinese	69

Slide 14.

SCI data show that the number and percentage of articles published by Chinese and other Asian scientists in English has increased enormously during the past two decades.

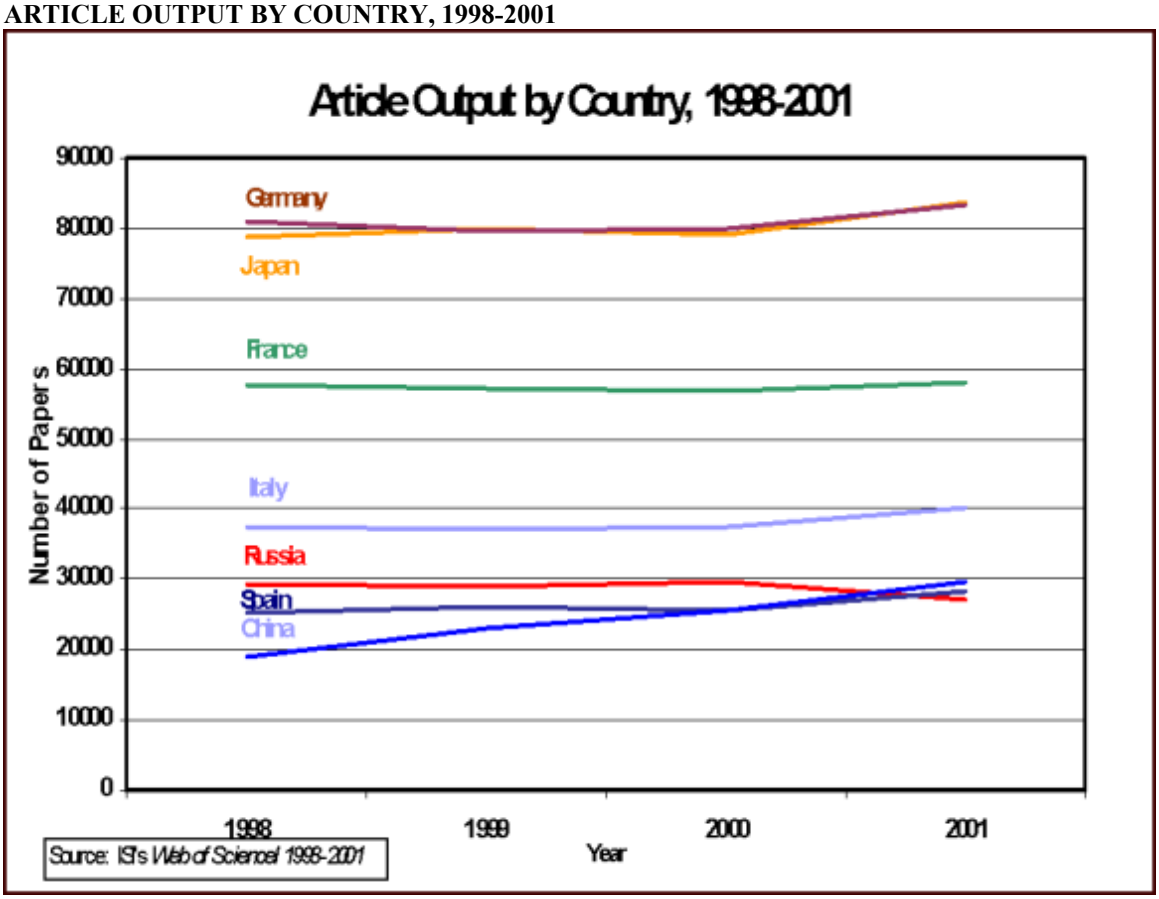
ARTICLE OUTPUT BY COUNTRY, 1977-1997

Slide 15 shows data for 1977 to 1997.



Slide 15a

ARTICLE OUTPUT BY COUNTRY, 1998-2001



Slide 15b.

And Slide 16 shows data for 1998 to 2001. In the last five years, the rate of growth for China surpasses the other countries shown.

NUMBER OF ARTICLES PUBLISHED BY CHINA, HONG KONG, AND TAIWAN, 1998-2002

Number of Articles Published by China, Hong Kong and Taiwan, 1998-2002

Year	PRC	Hong Kong	PRC & Hong Kong	Taiwan	World
1998	20,291	5,293	25,584	9,754	1,169,593
1999	24,862	5,767	30,629	10,095	1,177,747
2000	23,582	6,216	29,798	10,327	1,164,707
2001	29,386	7,268	36,654	11,985	1,201,560
2002	23,582	4,571	28,153	7,954	774,714

Source: ISI Web of Science, 1998-2002

Slide 15c

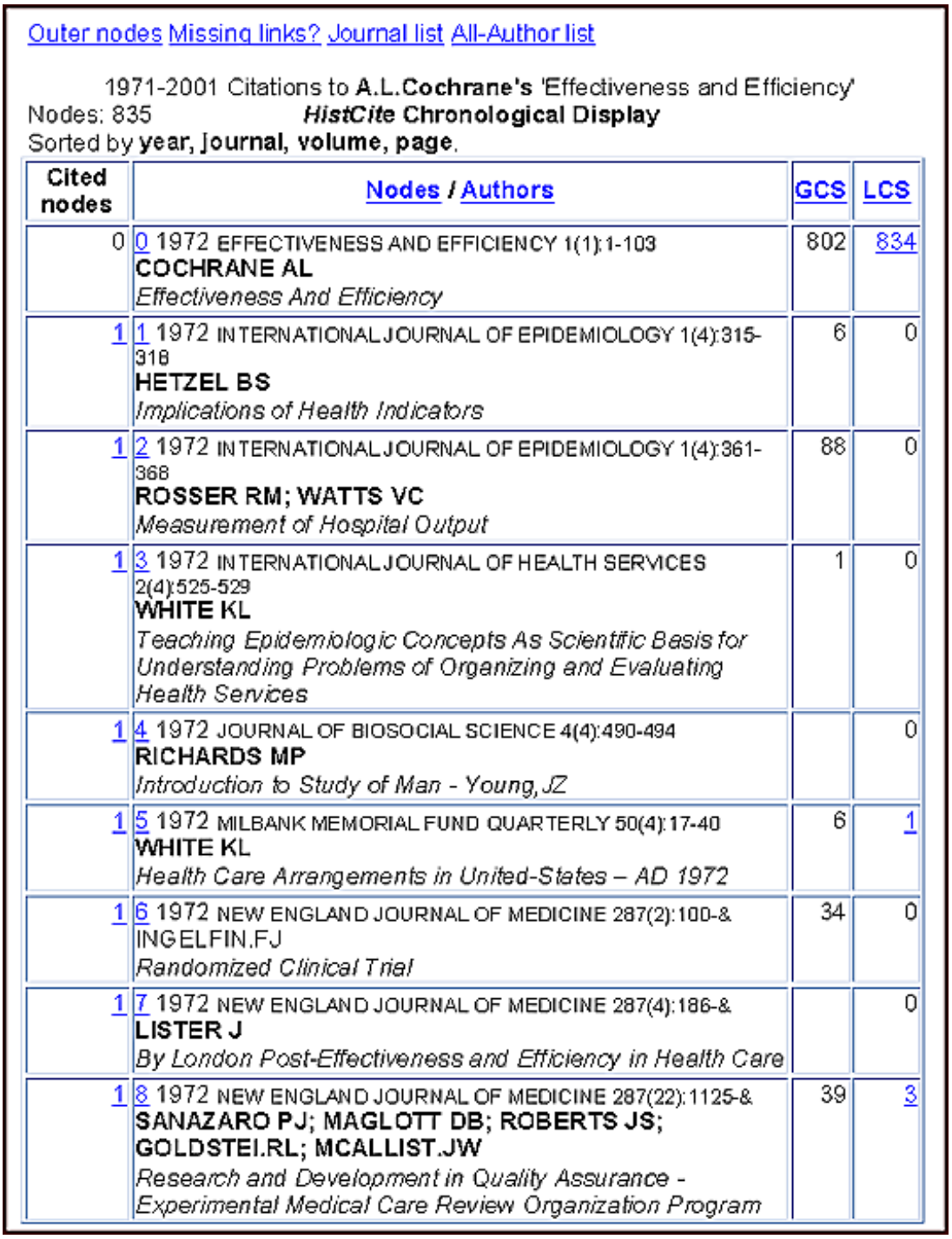
In the 2001 *Web of Science*, there were over 36,000 articles published by Chinese scientists. This includes PRC and Hong Kong. I do not have data on the number of articles that are published exclusively in Chinese journals not covered by ISI. Clearly these vernacular journals are appropriate for use in Chinese-speaking communities, especially clinical material. However, if Chinese medical science is to be accepted on an international level then it must be published in English or with extensive English summaries. Therefore it is important that all young Chinese scientists learn to speak and write English. I emphasize speaking based on my experience with Asian scientists. Unfortunately, in the past, their emphasis has been on writing and reading English. Not enough attention is paid to speaking. When Chinese students come to the United States or United Kingdom or Canada, they will be able to make the transition much more rapidly if they are able to speak and understand English. It is not sufficient to read and write.

Historiography

Thirty-five years ago, my colleague Dr. Irving Sher and I were interested in using citation data to help in writing of the history of contemporary science. We published a report in 1964[14] that demonstrated the potential for using bibliographic citations as a way of constructing what we called historiographs. In more recent years, working with a few Russian colleagues, we have developed a program called *HistCite*.[15] The process enables a variety of users to quickly obtain an historical overview of a topic. The best way to illustrate what this program does is to show you a few examples. As a first example, let me refer to the work of Archibald Cochrane who is the founder of evidenced-based medicine. He published his classic book on "Efficiency and Effectiveness" in 1971. Using the *Web of Science*, we retrieved over 800 articles which have cited that book.

Cochrane *HISTCITE*

This slide shows you how the information is displayed so that one can view the chronological development of the field. In order to appreciate the basic idea of citation-based historiography one has to visualize the scientific/medical literature as one enormous interconnected topological network, very much like the WWW itself. In this vast network, each paper is related to every other paper through citation linkages.



Outer nodes Missing links? Journal list All-Author list

1971-2001 Citations to **A.L.Cochrane's** 'Effectiveness and Efficiency'
Nodes: 835 ***HistCite* Chronological Display**
Sorted by **year, journal, volume, page**.

Cited nodes	Nodes / Authors	GCS	LCS
0	0 1972 EFFECTIVENESS AND EFFICIENCY 1(1):1-103 **COCHRANE AL** *Effectiveness And Efficiency*	802	834
1	1 1972 INTERNATIONAL JOURNAL OF EPIDEMIOLOGY 1(4):315-318 **HETZEL BS** *Implications of Health Indicators*	6	0
1	2 1972 INTERNATIONAL JOURNAL OF EPIDEMIOLOGY 1(4):361-368 **ROSSER RM; WATTS VC** *Measurement of Hospital Output*	88	0
1	3 1972 INTERNATIONAL JOURNAL OF HEALTH SERVICES 2(4):525-529 **WHITE KL** *Teaching Epidemiologic Concepts As Scientific Basis for Understanding Problems of Organizing and Evaluating Health Services*	1	0
1	4 1972 JOURNAL OF BIOSOCIAL SCIENCE 4(4):490-494 **RICHARDS MP** *Introduction to Study of Man - Young,JZ*		0
1	5 1972 MILBANK MEMORIAL FUND QUARTERLY 50(4):17-40 **WHITE KL** *Health Care Arrangements in United-States – AD 1972*	6	1
1	6 1972 NEW ENGLAND JOURNAL OF MEDICINE 287(2):100-& INGELFIN.FJ *Randomized Clinical Trial*	34	0
1	7 1972 NEW ENGLAND JOURNAL OF MEDICINE 287(4):186-& **LISTER J** *By London Post-Effectiveness and Efficiency in Health Care*		0
1	8 1972 NEW ENGLAND JOURNAL OF MEDICINE 287(22):1125-& **SANAZARO PJ; MAGLOTT DB; ROBERTS JS; GOLDSTEI.RL; MCALLIST.JW** *Research and Development in Quality Assurance - Experimental Medical Care Review Organization Program*	39	3

Slide 16.

GENE FLOW SMALL FILE 647

In the next example, I have chosen the topic of gene flow which is a subject of wide interest to population geneticists. In addition to the chronological display of 647 papers on this subject we are able to show you a graphical, genealogical presentation of the history of this topic. In addition to aiding the historian, *HistCite* provides librarians and students the ability to quickly identify the key works, authors, and journals on any topic in which they are interested.

The on-line demonstration will illustrate the various features of *HistCite*!

Outer References Missing Links? Journal list All-Author list Citation Matrix

Geneflow Papers - 1974 to August 2001

See the Historiograph of the 29 most cited papers in LCS by clicking here

Nodes: 620 ***HistCite* Chronological Display**

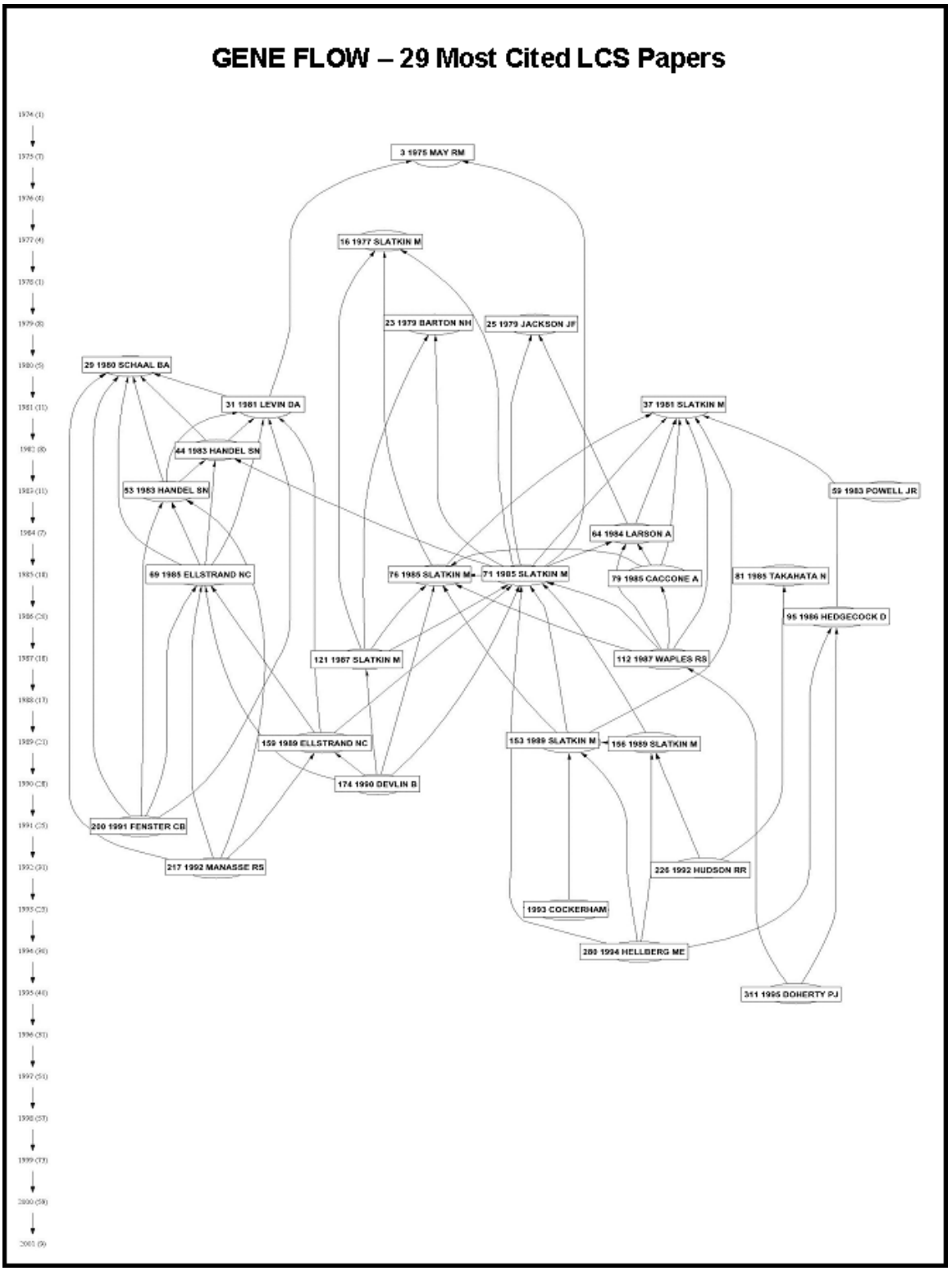
Sorted by **year, journal, volume, page**.

Cited nodes	Nodes / Authors	GCS	LCS
0	1 1974 GENETICS 78(3):961-965 **SPIETH PT** *Gene Flow and Genetic Differentiation*	43	9
0	2 1975 AMERICAN NATURALIST 109(969):597-601 **SLATKIN M; MARUYAMA T** *Influence of Gene Flow on Genetic Distance*	21	6
0	3 1975 AMERICAN NATURALIST 109(970):659-676 **MAY RM; ENDLER JA; MCMURTRIE RE** *Gene Frequency Clines in Presence of Selection Opposed by Gene Flow*	88	15
0	4 1975 AUK 92(3):493-510 **COOKE F; MACINNES CD; PREVETT JP** *Gene Flow Between Breeding Populations f Lesser Snow Geese*	71	3
0	5 1975 GENETICS 80(2):349-361 **MCKENZIE JA** *Gene Flow and Selection in a Natural Population of Drosophila- Melanogaster*	17	0
0	6 1975 GENETICS 81(4):787-802 **SLATKIN M** *Gene Flow and Selection in a 2-Locus System*	52	3
0	7 1975 HEREDITY 34(JUN):407-415 **BRUSSARD PF; VAWTER AT** *Population Structure, Gene Flow and Natural Selection in Populations of Euphydryas-Phaeton*	9	0
0	8 1975 JOURNAL OF MOLECULAR EVOLUTION 5(3):177-185 **ADAMS RP** *Gene Flow Versus Selection Pressure and Ancestral Differentiation in Composition of Species - Analysis of Populational Variation of Juniperus-Ashei Buch Using Terpenoid Data*	21	0
0	9 1976 GENETICS 83(3):S64-S64 **RODELL CF**		0

Slide 17.

GENE FLOW GRAPH

This is a prototype graph that is created by computer and includes the 29 most-cited papers in the LCS.



Slide 18

BLUMBERG

As a final example, I have assembled a bibliography of all of the 6870 papers that have cited the work of Nobelist Dr. Baruch Blumberg. He is known to many of you as the discoverer of the Australian antigen which led to a vaccine for Hepatitis B. Here you see that his work has been in cited over 6,000 papers. By clicking on various hot links as e.g. "outer references" one can see other important works in this field.

Outer References Missing Links? Journal list All-Author list Citation Matrix

Articles by and citing BS Blumberg, 1954-2002
HistCite Guide

Nodes: 6870
Sorted by **year, journal, volume, page**.

Cited nodes	Nodes / Authors	GCS	LCS
0	1 1954 SCIENCE 120(3115):432-433 **BLUMBERG BS; OSTER G** *Light-Scattering Studies on Hyaluronic Acid*	32	32
0	2 1955 ANNALS OF THE RHEUMATIC DISEASES 14(4):432-433 **BLUMBERG BS** *Natural History of Marie-Strumpell Arthritis (Rheumatoid Spondylitis)*	1	1
1	3 1955 BIOCHEMICAL JOURNAL 61(4):688-696 **CURTAIN CC** *Nature of the Protein in the Hyaluronic Complex of Bovine Synovial Fluid*	43	15
1	4 1955 JOURNAL OF CLINICAL INVESTIGATION 34(9):1454-1461 **BLUMBERG BS; OSTER G; MEYER K** *Changes in the Physical Characteristics of the Hyaluronate of Ground Substance with Alterations in Sodium Chloride Concentration*	14	14
1	5 1955 JOURNAL OF THE AMERICAN CHEMICAL SOCIETY 77(16):4197-4201 **SCHUBERT M; LEVINE A** *A Qualitative Theory of Metachromasy In Solution*	84	1
1	6 1956 ANNUAL REVIEW OF PHYSIOLOGY 18():69-88 **DORFMAN A; MATHEWS MB** *The Physiology of Connective Tissue*	13	2
1	7 1956 BIOCHEMICAL JOURNAL 63(4):715-717 **BLUMBERG BS; OGSTON AG** *Selective Solvation of the Hyaluronic Acid Complex of Ox Synovial Fluid*	17	17
1	8 1956 BIOCHIMICA ET BIOPHYSICA ACTA 19(3):480-489 ROWEN JW; **BRUNISH R; BISHOP FW** *Form and Dimensions of Isolated Hyaluronic Acid*	24	0
1	9 1956 BIOCHIMICA ET BIOPHYSICA ACTA 21(3):506-518 **MEYER K; DAVIDSON E; LINKER A; HOFFMAN P** *The Acid Mucopolysaccharides of Connective Tissue*	606	10

Slide 19.

I have covered a variety of information topics. I will be glad to answer any questions you may have about *The Scientist*, *Current Contents*, *Science Citation Index*, citation analysis, journal impact factors, and historiographic analysis.

Thank you.

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