

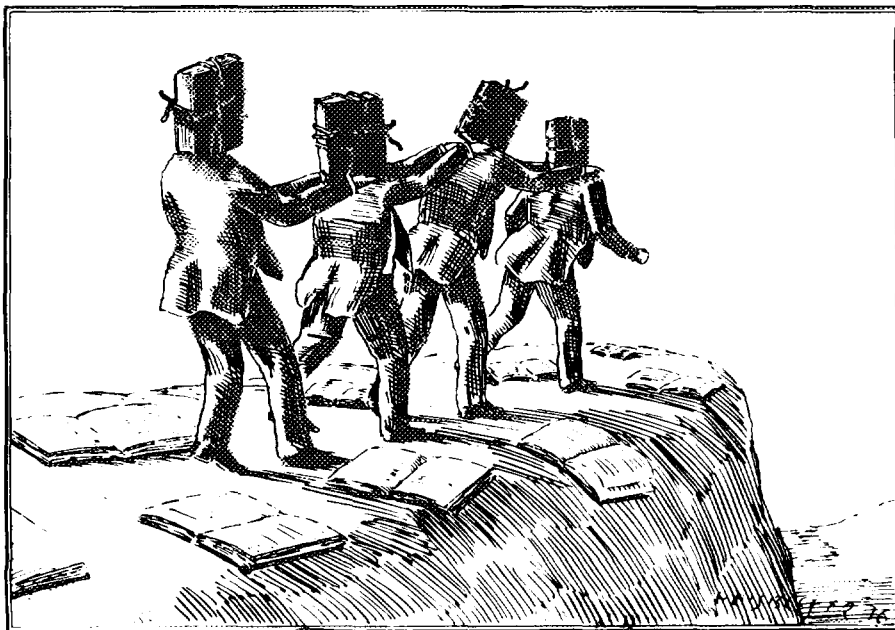
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Is French Science Too Provincial?

■ Can one evaluate a scientific article by the number of times it's been cited? An answer to that question probably can't be attempted with too great caution. The use of quantitative data alone risks distortion of the complexity of the process of scientific publication. Indeed, one can take the position that number of citations cannot serve as even an approximate measure of scientific worth.

■ Nevertheless, some numbers and comparisons furnish food for thought. Eugene Garfield is president of the Institute for Scientific Information, which includes among its services Current Contents, well-known to most research scientists. Here Dr. Garfield examines the case of France. Are French journals cited frequently? What journals cite French authors? His findings are far from complimentary, and certainly not beyond argument. But they agree with a picture of French science that is not unique with Dr. Garfield, a picture it will be dangerous to ignore.



• About twenty years ago, I made my first visit to France. In those days I was able to read and speak French well enough to pass my doctoral language exams. As a student of linguistics, I was aware not only of the beauty of the French language but also of its vital role in the history of language, literature, diplomacy, and science. However, even 20 years ago, certain French scientists were asserting that their work was being ignored by American scientists too lazy to learn French. By

the time I returned to France in 1961 these protests were increasing, and by the time I first lectured in Paris in 1965 about the then new *Science Citation Index*®, the feeling of neglect among French scientists had grown into a national mania. When French scientists first saw the *SCI*® their fears were confirmed: the data showed that their work was seldom cited by the Americans and the British. Is it a coincidence that to this day the *SCI* is used less in France than in any other country of her size?

I hope my French colleagues will forgive me for stating a painful observation: that today French science appears to be in decline. The reasons have much to do with French support for education and research, which, in comparison with that of other nations, has not been commensurate with the country's population and wealth. Surely a nation which has produced Pascal, Lavoisier, Pasteur, and Monod is capable of producing more giants of science. But it is clear that over the past three decades the conditions for fostering such giants have not been present in France. The most obvious symptom of the decline of French science is the refusal of French scientists to recognize that French is no longer a significant international language. By publishing the results of their research exclusively in the French language, French researchers prevent their findings from being casually read by the rest of the world's scientific community.

My basis for making this observation is the publication record of French scientists and French journals. This data is compiled each year in the *Science Citation Index (SCI)*, an international index to the scientific literature published by the Institute for Scientific Information®, of which I am president. Since modern science depends so heavily on the exchange of scientific information, the record of this exchange is the most comprehensive, most objective evidence on which to base an assessment of the scientific contribution of a nation, a university, a journal, or even an individual.

When one scientist cites the work of another in a published report, he or she registers an assessment of the value of the other's contribution. The aggregation of a vast number of citations comprises a consensus of the world's publishing scientists. Extensive studies have confirmed that there is a significant correlation between research performance and the number of times a scholarly article is cited in the literature.¹

The Institute for Scientific Information recently completed a citation study of French journals.² In the study, 129 journals which are published in France and indexed by the *Science Citation Index* were treated as though they constituted a single journal. We then determined which journals this single French aggregate cited most frequently, and which journals published throughout the world cited the French aggregate most frequently.

Since the study covered only journal issues published in France in 1974, strictly speaking we cannot claim that the study covered all of French scientific literature--either from a linguistic or a scientific standpoint. Many French scientists publish in international or other non-French journals, and of course there are many articles written in French for journals published outside of France. Nevertheless, this group of 129 French journals probably gives us a general idea of trends in French science.

The 129 French journals represent about 5.3% of the total of 2,443 journals indexed by the *SCI* in 1974. However, these 5.3% French journals produced only 3.8% of the total source items indexed in 1974, and only 2.6% of the references. This indicates that France's journals are small in comparison with those of other nations. No matter how mediocre, larger journals tend to receive higher citation counts. While the "average" scientific article made reference to about 13 previous articles, the "average" article in French journals made only 8.6 such references. This in itself is a national peculiarity.

The French are primarily cited by the French

The data also indicate that the French themselves are the greatest citers of the French. Of the ten journals which most frequently cited French journals in 1974, seven are themselves French. But of the ten journals most frequently cited by the French, only three are themselves French. Of the 50 journals most frequently cited by the French, only ten are French journals.

If the French journal literature is a characteristic segment of the international scientific literature, a list of the 50 journals most frequently cited by all French journals should correspond fairly well to a list of the 50 journals most frequently cited by the scientific literature as a whole in 1974. But in fact there are telling differences, both in ranks and in citation totals.

For example, in 1974 the most highly cited of scientific journals was the *Journal of the American Chemical Society*. All things being equal, it should appear first on a list of journals most frequently cited by French journals, and it is. Since, as noted above, the French journals contributed 2.6% of all references processed for the *SCI*, they should--all things again being equal--account for 2.6% of the citations

received by the *Journal of the American Chemical Society* in 1974. As a matter of fact, the French journals account for 2555, or just about 2.6%.

But all things are not equal, and except in a few cases the journals most highly cited by the French are not identical with those most highly cited by the rest of the international scientific community. For example, in 1974 the second most highly cited single journal was the *Journal of Biological Chemistry* with an extremely high impact factor of 5.84. All things being equal, it should appear second on a list of journals most frequently cited by French journals. It does not. Instead, the journal second most highly cited by French journals was *Bulletin de la Societe Chimique de France*, with an impact factor of 0.77. It was cited by all journals 6,671 times, so the "expected" 2.6% French citation total would be 173. The actual number of French citations is 2,471. Although the *Bulletin* ranks second in French citations, it ranks ninety-fifth in worldwide citations. In fact, in every case where the ratio of French citations to worldwide citations exceeds 10%--about four times the expected rate of 2.6%--the citing journals are French journals.

The heavy citation of French journals by French journals is not wholly a matter of language, although language undoubtedly plays a part. For example, (*Nouvelle*) *Presse Medicale*, which ranks 365th when all scientific journals are listed in order of total citations received in 1974, ranks 6th on a list of journals most frequently cited by the French. Just above (*Nouvelle*) *Presse Medicale*, in fifth place on the French list, is *Lancet*--which was cited by French journals relatively more frequently than by the worldwide literature as a whole. It is clear that (*Nouvelle*) *Presse Medicale* is highly ranked by the French because it is about French medicine. *Lancet* is highly ranked by the French because it is an internationally important journal. It does not return the compliment except on rare occasions.

In another part of the same ISI® study of French journals, a listing of the 50 journals that most frequently cited French journals clearly showed that these were predominantly French journals, and that their self-citing rate was much higher than normal. This indicates that the scientific literature published in France is mainly of low impact. The French journals cite foreign literature much more heavily than their own, while their own literature is cited mainly by themselves. It is like a cosmopolitan city that is ignored by the rest of the world.

The limited dissemination of French journals.

The finding that the French scientific literature is of generally low impact has been supported in a study by F. Narin et al.³ The study covered 492 leading journals over a time span from 1965 to 1971. Over this time period, the study found, the United States led the world in number of publications, followed at a significant distance by the U.S.S.R. Far below these two countries were the United Kingdom, Germany, Japan, and finally France. In 1972, for example, although France fared better than the Soviet Union and Japan in clinical medicine, France fared worst in engineering in the world, with only 2.1% of the total. In contrast, the United Kingdom published 11.8%, West Germany 6.8%, the Soviet Union 7.2%, and Japan 4.4%.

Measuring outside-of-country citations, the authors found that the United States is most highly cited by the outside world. The U.K. ranks next, with West Germany, Japan, and "other" countries approximately equal. France ranks significantly below them, but the Soviet Union receives the fewest citations by far from the outside world.

The most biting finding of this citation study was the very low ratio of citations to publications for France--what we call impact. The authors asserted that, "The citations/publications ratio is lower for France in every field than it is for any major country, or all the other countries combined. ... Much of the low level of citations/publications for the French literature may well be due to the counting of a large number of relatively small sized articles in *Comptes Rendus*. If the articles are short, they presumably contain less material likely to be cited, and would have a relatively low number of citations per article."³ The practice of splitting a longer article into two or three smaller parts, although raising the total publication count, results in fewer citations per publication. Multi-part articles might be better left intact.

In 1972 I examined the performance of the world-famous *Comptes Rendus* in a study of citation analysis as a tool in journal evaluation.⁴ *CR*'s performance in terms of sheer numbers of citations was quite impressive--in fact, it ranked 13th worldwide in frequency of citations, indicating that it is a major archival journal. However, its impact factor--the average number of citations per published item--was only 0.788 for 1969, and had dropped

• Journals that cited French journals in 1974. For each title the table indicates: **A** = total number of citations of other journals, **B** = total number of citations of French journals, **C** = number of self-citations, **D** = B/A (percentage of French citations in terms of total citations), **E** = C/A (percentage of self-citations in terms of total citations), **F** = C/B (percentage of self-citations in terms of French citations), **G** = impact factor.

• Journals are listed in order of the frequency with which they cited French journals, thus, it is in the *Comptes rendus de l'Academie des sciences (Series D)* that one finds most references to French journals (1,952). Next, in descending order of total citations of French journals, come the *Bulletin de la Societe Chimique de France* (1,379), the *Comptes rendus de l'Academie des Sciences (Series C)* (1,151), etc.

• Many of the figures seem to be significant. Thus the figure in column D for the *Comptes Rendus (Series A)* is 30.6%. That means that this journal cites a large percentage of French journals. But it is even more noteworthy that, eight times out of ten, this citation of French journals is self-citation . . . (very high self-citation rate, whether in terms of all citations, 24.6%, or in terms of all French citations, 80.6%). These data should be interpreted with caution. In any event, this excess of self-citation in many French journals is slightly disturbing, especially in view of the fact that the impact of these same journals on the international scientific literature is so limited.

JOURNAL	A	B	C	D	E	F	G
1. C. Rend. Acad. Sci. D Nat.	11129	1952	1317	17.5	11.8	67.5	0.51
2. B. Soc. Chim. France	11102	1379	869	12.4	7.8	63.0	0.77
3. C. Rend. Acad. Sci. C Chim.	4762	1151	573	24.2	12.0	49.8	0.51
4. Semaine Hopitaux	5603	882	125	15.7	2.2	14.2	0.29
5. Nouv. Presse Medicale	4900	801	323	16.3	6.6	40.3	0.60
6. J. Organomet. Chem.	22699	655	—	2.9	—	—	2.38
7. C. Rend. Acad. Sci. A Math.	1924	588	474	30.6	24.6	80.6	0.20
8. J. Chim. Physique	4489	556	367	12.4	8.2	66.0	0.88
9. C. Rend. Acad. Sci. B. Phys.	2243	466	302	20.8	13.5	64.8	0.44
10. Analytical Chemistry	27658	435	—	1.6	—	—	3.29
11. Tetrahedron	13059	404	—	3.1	—	—	1.57
12. Ann. Chirurgie	1916	394	79	20.6	4.1	20.0	0.16
13. C. Rend. Soc. Biol.	1926	367	232	19.1	12.0	63.2	0.30
14. Lyon Medical	2771	365	49	13.2	1.8	13.4	0.24
15. Arch. Maladies Coeur	2466	358	221	14.5	9.0	61.7	0.64
16. J. Amer. Chem. Soc.	46267	343	—	0.7	—	—	4.38
17. J. Chem. Soc. Perkin	20327	342	—	1.7	—	—	1.34
18. J. Organic Chemistry	21976	326	—	1.5	—	—	1.49
19. Revue Rhumatisme	1543	315	103	20.4	6.7	32.7	0.48
20. Tetrahedron Letters	11178	269	—	2.4	—	—	1.77
21. Pathologie Biologie	2866	252	49	8.9	1.7	19.4	0.56
22. Lille Medicale	1842	249	41	13.5	2.2	16.5	0.13
23. Canad. J. Chemistry	12685	240	—	1.9	—	—	1.39
24. Biochimie	4677	236	154	5.0	3.3	65.3	1.63
25. Neuro-Chirurgie	1363	230	66	16.9	4.8	28.7	0.36
26. J. Radiol. Electrol.	1264	223	65	17.6	5.1	29.1	0.21
27. Arch. Fr. Pediatrie	1642	215	72	13.1	4.4	33.5	1.01
28. J. Chirurgie	1265	215	14	17.0	1.1	6.5	0.15
29. J. Microscopie (Paris)	1634	212	129	13.0	7.9	60.8	1.60
30. Eur. J. Med. Chem.	1541	207	112	13.4	7.3	54.1	—
31. Brain Research	19626	198	—	1.0	—	—	3.10
32. Ann. Cardiol. Angeiol.	1132	192	13	17.0	1.1	6.8	0.35
33. Deut. Med. Wschr.	—	187	—	—	—	—	—
34. Biochim. Biophys. Acta	45366	185	—	0.4	—	—	3.11
35. Coeur Med. Interne	1308	184	30	14.1	2.3	16.3	0.53
36. Physical Review B	27280	181	—	0.7	—	—	2.86
37. Ann. Radiologie	1122	180	24	16.0	2.1	13.3	0.39
38. J. Urologie Nephrol.	1171	180	107	15.4	9.1	59.4	0.18

to 0.383 by 1974. In contrast, over 1500 other journals performed better. Over 300 journals had impact factors of over 2.0. The impact of the average *Comptes Rendus* article is extremely low and getting lower.

Similarly, *Presse Medicale* is widely respected among international medical journals. But its impact, which is very high relative to other French journals, ranks low in international comparison, although it rose from 0.494 in 1969 to 0.612 in 1974. France's share of the journals which excel is painfully low, especially for a country of her size and research effort.

The more distinguished French scientists published in foreign journals.

A careful examination of the citation data for many highly ranked French scientists has clearly shown that these scientists all share one characteristic: each publishes in English or in international journals outside of France. For example, most of Monod's articles were published in the *Journal of Molecular Biology*.

These highly-cited scientists wisely recognize that for the author who wishes to assure that his scientific contribution reaches the largest possible circle of readers, it is imperative to

1. 396 **Thiery J P.** Mise en evidence des polysaccharides sur coupes fines en microscopie electronique (Electron-microscopic demonstration of polysaccharides in fine sections). *J. Microscopie* 6:987-1018, 1967.
2. 377 **Mulliken R S.** Quelques aspects de la theorie des orbitales moleculaires (On some aspects of the molecular orbital theory). *J. Chim. Phys.* 46:497-542, 1949.
3. 290 **Novikoff A B & Woo-Yung Shin.** The endoplasmic reticulum in the Golgi zone and its relations to microbodies, Golgi apparatus and autophagic vacuoles in rat liver cells. *J. Microscopie* 3:187-206, 1964.
4. 256 **Rosset R, Monier R & Julien J.** Les ribosomes d'*Escherichia coli*. I. Mise en evidence d'un RNA ribosomique de faible poids moleculaire (Ribosomes of *E. coli*. I. Demonstration of a ribosomal of low molecular weight). *B. Soc. Chim. Biol.* 46:87-109, 1964.
5. 213 **Sussman R & Jacob F.** Sur un systeme de repression thermosensible chez le bacteriophage λ d'*Escherichia coli* (On a system of heat-sensitive repression in the lambda bacteriophage of *E. coli*). *C. Rend. Acad. Sci.* 254:1517-1519, 1962.
6. 193 **Gabe M.** Sur quelques applications de la coloration par la fuchsine-paraldehyde-improved Gomori's aldehyde-fuchsin (On some applications of the fuchsin-paraldehyde stain-improved Gomori's aldehyde-fuchsin). *B. Micr. Appl.* 3:152-162, 1953.
7. 185 **Lejeune J, Gautier M & Turpin R.** Etude des chromosomes somatiques de neuf enfants mongoliens (Study of somatic chromosomes in nine cases of mongolism). *C. Rend. Acad. Sci.* 248:1721-1722, 1959.
8. 184 **Cohen G N & Rickenberg H V.** Concentration specifique reversible des amino acides chez *Escherichia coli* (Specific reversible concentration of amino acids in *E. coli*). *Ann. Inst. Pasteur* 91:693-720, 1956.
9. 181 **Gabriel P.** Des categories Abeliennes (Abelian categories). *Bull. Soc. Math. France* 90:323-448, 1962.
10. 167 **Rickenberg H V, Cohen G N, Buttin G & Monod J.** La galactoside-permease d'*Escherichia coli* (Galactoside perinease in *E. coli*). *Ann. Inst. Pasteur* 91:829-857, 1956.
11. 161 **Dutrillaux B & Lejeune J.** Sur une nouvelle technique d'analyse du caryotype humain (A new method for analysis of human karyotypes). *C. Rend. Acad. Sci.* 272:2638-2640, 1971.
12. 159 **Lejeune J, Gauthier M & Turpin R.** Les chrompsomes humains en culture de tissu (Human chromosomes in tissue cultures). *C. Rend. Acad. Sci.* 248:602-603, 1959.
13. 153 **Drach P.** Mue et cycle d'intermue chez les crustaces decapodes (Molting and the inter-molting cycle in decapod crustaceans). *Ann. Inst. Oceanogr. Monaco* 19:103-391, 1939.

List of articles published in french journals that were cited more than 150 times in the international literature during the period 1961-1975

publish in English. But according to the results of a recent, informal ISI survey, only about 20% of French papers are published in non-French journals.

It is not linguistic imperialism that prevents English-speaking scientists from reading French articles. Indeed, many of them regularly read *La Recherche* partly in order to exercise their French. The typical American or British scientist greatly admires the French language. But while he may be content to struggle with his French on a holiday visit to France, he cannot afford this struggle in the research environment--although most will struggle through an important contribution. But he probably lacks the time to read all pertinent articles published in English, much less what is published in French, German, Russian, or Japanese. He also lacks the facility to scan a French contents page.

Although genuinely significant contributions will be cited no matter what language they are reported in, only the strongest motivation can cause the typical English-speaking scientist to read a French article which at first seems to be of casual interest. And yet this casual exposure is essential to the spread of ideas between disciplines. The insistence of French scientists to publish in French denies the world scientific community the opportunity to read their work casually.

At the very least, all French journals should require the publication of summaries or abstracts as well as contents pages in English. The use of English contents pages will undoubtedly cause more reprint requests; whether it causes more citations will depend on the quality and relevance of the contributions. Of a sample of 267 French-language journals covered by the *Science Citation Index* in 1974, 133 *did* contain a separate English contents page. More significant, 108 *did not*. Nineteen contained a mixed English-French contents page, and 7 used some English abstracts.

Comptes Rendus, to take just one example, should be published in an English edition. Recently, the editors reached a decision (in which the Institute for Scientific Information was instrumental) to begin using English contents pages. Whether this sensible decision will be reflected in the citation data remains to

be seen. However, I am surprised that no publisher has yet seized the opportunity to publish a cover-to-cover English translation of *Comptes Rendus*. I suspect that such a publication, which could be at least partially subsidized by foreign subscribers, might be well received. After all, if we can justify the cover-to-cover translation of many Russian journals, can't the same be done for the French? The joint publication of English and German editions of *Angewandte Chemie* is but one successful example of this type of international cooperation. But translation alone will not make up for poor quality.

The true international scientific language: English.

But it has become prohibitively expensive to maintain multilinguality. Only in the case of a few outstanding journals can we afford the luxury of cover-to-cover translations. Throughout the world, practically all prospective readers--even those who might prefer some other language--can immediately understand a scientific article published in English. French scientists must recognize that French is no longer *the* international language, and the adoption of English as the world language of science should be encouraged.

Today in France there is a confusion of priorities. No one denies that French scientists should have the opportunity to achieve proper international recognition. But that recognition is being sacrificed to the futile goal of preserving the French language by artificial means.

The French language will not decline because of French scientists publishing in English, Esperanto, or any other language. As long as French mothers and fathers continue to speak French to their children, French will continue to be spoken--even if their children grow up to become scientists. But in order to become contributing members of the international scientific community, French scientists cannot refuse to learn English. Neither France nor the French language will ever suffer for having encouraged the development of a strong cadre of internationally recognized bi-lingual scientists.

1. Garfield E. Citation indexing for studying science. *Nature* 277:669-71, 1970.
2. -----, Journal citation studies. 23. French journals--what they cite and what cites them. *Current Contents*® No. 4, 26 January 1976, p. 5-10.
3. Narin F & Carpenter M P. National publication and citation comparisons. *J. Amer. Soc. Inform. Sci.* 26:80-93, 1975.
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Le Nouveau Défi Américain. I.

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In 1967 the Frenchman Jean-Jacques Servan-Schreiber jolted his fellow citizens by publishing *Le Défi Américain*.¹ In the past decade the book's title has become a catch-phrase for all sorts of challenges. I did not realize until recently the extent to which Servan-Schreiber stressed the importance of the information industry, but in a recent re-reading of the book's English translation I came upon this startling conclusion: "The new frontiers of human creativity in every area lie in information systems and their utilization, and the Americans themselves do not seem fully to realize this yet. We [presumably the French] must forge ahead into this area before it is taken over by others."²

This assertion is ironic in light of the recent *cause célèbre* in which I have been involved. For lack of a better description, I have called it "Le Nouveau Défi Américain"; modesty forbids my naming it the "Garfield Challenge," since I have already named both a law³ and a constant⁴ after myself.

Last fall I published an article in *La Recherche* entitled "Is French Science Too Provincial?"⁵ I said what I had to say about the French in French, but the English translation is reprinted on the following pages.

The reaction to this article has been intense. As Barbara Burke of the *Washington Post* reported from Paris just a few weeks ago, "French Scientists Resent Dominance of English!"⁶ One French scientist has denounced the article as "pernicious"; another accused me of "linguistic imperialism"; and still another claimed that my article "questions the existence of a civilization...." It seems that I have hit a raw nerve.

Readers of *La Recherche* have had their chance to reply to the "New American Challenge," and have certainly taken advantage of it--as I'll demonstrate at length in this space next week. In the following pages you can examine for yourself the original source of their outrage.

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2. -----, *The American challenge*. New York: Atheneum, 1969.
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4. -----, Is the ratio between number of citations and publications cited a true constant? *Current Contents* No. 6, 9 February 1976, p. 5-7.
5. -----, La science française est-elle trop provinciale? *La Recherche* 7:757-60, 1976.
6. Burke B. French scientists resent dominance of English. *Washington Post* 20 March 1977, p. E6.