

Problems of the Primary Journal*

DAVID E. GUSHEE

American Chemical Society, 1155 Sixteenth Street, N. W., Washington, D. C. 20036

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The basic problem of the primary literature is that the material to be published grows more rapidly than the number of people or institutions interested in buying it. Over the years, the American Chemical Society has dealt with this problem through creation of new journals, imposition of page charges, solicitation of advertising revenue, and subsidy. All these have limits, but the combination has caused the ACS journal program to be economically viable and promises to continue it viable for the next decade, at least. The main requirement for viability is to identify the time to create a new journal and the field it will seek to cover.

The basic problem of the primary literature is that the material to be published grows more rapidly than the number of people or institutions interested in buying and/or using it. A smaller, but still nagging, difficulty is that unit costs increase more rapidly than publishers are able to increase unit productivity.

All discussions of the future course of primary literature seek ultimately to deal with these two cost-price squeezes. They may be concealed behind sociological or computer terminology; they may follow from statements that information is a national or international resource; they may be expressions of improved understanding of how scientists learn what they need to know to do science. But in the last analysis, the primary literature would easily be able to continue basically unchanged, were it not for the fact that the demand has stabilized, while the supply of material has not yet done so.

This statement may strike you as inappropriate in the era of information science, with so much discussion actively going on based on contrary premises. Let me try to show you why I think it accurate, using data from ACS programs as a basis.

In the period 1958 to 1968, the American Chemical Society journal publication program has expanded as shown in Table I. From seven journals, we have grown to 19. From about 40 people, we now have almost 100. From a gross expenditure of about \$2 million, we have increased to \$4.7 million last year.

The number of articles submitted has increased from 6700 to 11,700 last year. The number published has grown from 4800 to 7600.

Perhaps the most meaningful number, though, in terms of information content, is pages. From about 17,000 in 1958, we have expanded to the 1968 level of more than 37,000. Although there is a minor variation in typography over the 10 years, the major variable is manuscript length, as shown in Table II.

You will note that today's articles are much longer than their counterparts 10 years ago. If you take into

account the fact that we now publish more Communications (at about a page each) than we did then, you can see that the average article today has increased from less than 4 pages to more than 5 pages.

We have checked into the possibility of modified editorial standards being the cause of this increase in article length. Anything done in this regard is highly qualitative, to be sure, but every test shows more information in total and more information per unit of article length now than 10 years ago. Checks include *Chemical Abstracts* index terms per article, typographical word density, data points per article, etc. When one considers how much information modern instrumentation can generate, one concludes that the ability of a scientist to generate data, rather than a relaxation of standards, is probably the reason for both the longer articles and the increased number of articles.

There is still the possibility that the problems under investigation are less meaningful scientifically, but that consideration is not relevant to the primary literature problem. The profession itself determines scientific

Table I. Ten-Year Growth of ACS Journals

1958		1968
7	Number of publications	19
40	People (full time equivalents)	95
6700	Papers submitted	11360
4800	Papers published	7600
17000	Pages published	37000
\$2.1 million	Expenditures	\$4.7 million

Table II. Comparison of Paper Length in ACS Journals, 1958 vs. 1968

1958		1968
4800	Papers published	7600
17000	Pages published	37000
3.6	Average paper length (pages)	4.9
1	Average communication length (pages)	1
3.8	Average article length (pages)	5.3

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significance—publishability—via the refereeing process, so even if it does so less than optimally, it has determined the criteria to be applied.

The next question is whether ACS primary literature experience is representative of the profession as a whole. For this we turn to *Chemical Abstracts*, as shown in Table III. CA published about twice as many abstracts in 1968 as in 1958. The growth rate of our journals is, therefore, roughly reflective of the profession as a whole and, at 37,000 pages, large enough for some meaningful analysis and extrapolation.

Let us turn now to the consumers of this information, as reflected by our subscriber patterns (Table IV). We use subscribers rather than readers because we know how many there are, who they are, and where they are. Further, we know that they have sufficient interest in our publications to put out money for them, whereas pass-along readers demonstrate that they are not sufficiently interested to spend money for our publications.

In 1933, all 17,000 ACS members subscribed to all 3 ACS publications (and to *Chemical Abstracts* as well, although I have not included those numbers here). In 1948, 60% of the members subscribed to one of the 3 journals. In 1958, with 7 journals, only 35% or so of the members subscribed to journals, a proportion that has stayed rather constant since.

This means that we have hardly any more member-subscribers today than we had 20 years ago, despite an increase in membership of 55,000 chemists and chemical engineers. This relatively constant number of people interested in buying journals, therefore, represents the individuals the Society publications serve directly. The number of institutions buying our journals has increased over the decade, but, unfortunately, our historical records are not good enough to show how many have been added.

So much for the first factor in the cost-price squeeze. I think it is clear that the demand is not growing at the rate the supply is. How about the unit cost factor?

If you divide the \$2 million in 1958 by the 17,000 pages, you get \$118 per page. The same calculation for 1968 shows \$127 per page. That is a good record, but it would be misleading for me to let you think that such a calculation has much meaning. In the seven, as in

the 19, are apples and oranges, journals whose mission is specifically the recording of research and journals whose missions are more complex and whose costs, therefore, are greater.

For the journals themselves, I have not been able to generate unit costs from the 1958 records on the same basis as the 1968 costs, because bookkeeping practices within the Society have changed so much. Since 1966, when the current reporting system was adopted, the cost per page has remained rather stable and is about \$100.

For the sake of discussion, and for background relative to suggestions later for modification of the primary literature, the basis of journal cost is the number of pages printed. The staff needed to process manuscripts and the mechanical cost of preparing the manuscript for printing both vary primarily as a function of pages, and together comprise some 80% or more of the total. That means that if we print only one copy of an issue, we pay more than 80% of what we pay on printing 15,000 or 20,000 copies. Printing 1000 or even 5000 more copies doesn't add much relatively to our total cost, compared to how much it costs to get that first copy.

A scientific society cannot, however, control cost as the typical business can. In journal publishing, the only real cost we can save is the page we don't print. And to restrict the number of pages printed is to interfere with the dissemination of knowledge, which is, after all, the basic reason the Society exists in the first place.

Price, on the other hand, depends primarily on the number of paid subscriptions. The addition of an extra 1000 subscriptions makes it possible to reduce the price per subscription markedly. This is true whether there are page charges or not; the total number of dollars needed is smaller with page charge revenue available, but the principle with regard to subscription price remains the same.

When designing journals, therefore, one should theoretically seek the best possible combination of number of pages and number of subscribers. Experience has shown that a journal becomes scientifically and economically self-sustaining when it publishes from around 1500 pages up to around 10,000 or so. At these levels, it can attract buyers in numbers of 5000 to 20,000, and can therefore distribute the costs over enough subscribers to cause the subscription price to be low enough for individuals to buy.

Should the number of pages go over some critical number, then we get into a position of having to charge such a high price that individuals can no longer afford the journal. *Chemical Abstracts*, as an entity, reached that point some years ago and can no longer be considered a publication for individual subscriptions.

Should the number of pages go too low, authors are reluctant to publish in the journal, on the basis that they are known by the company they keep and the association is not flattering.

In principle, therefore, the range within which journals should operate is clear, at least qualitatively. Unfortunately, scientific attitudes do not necessarily accord with these economic realities. It is extremely difficult to cause a diffuse and heterogeneous reference group such as chemists to desire to control their literature by the mechanisms these considerations say are

Table III. Growth of Chemical Abstracts vs. ACS Journal Papers

1958		1968	Increase
95700	CA papers abstracted	198035	108%
4800	ACS journal papers published	7600	60%
17000	ACS pages published	37000	116%

Table IV. Subscriptions vs. Membership

Year	No. of Members	No. of Members Subscribing	% of Members Subscribing	Total No. of Member Subscriptions	Total Subs.
1933	17600	17600	100%	52800	
1948	58800	35000 ^a	60% ^a	61061	84946
1958	85800	30000 ^a	35%	47622	87815
1963	96700			61226	123211
1968	113400	40000	37%	86445	202738

^a Estimated.

appropriate—breaking off from a large journal a subject category that in itself is large enough to become a viable journal, while leaving the parent journal still prestigious and viable.

The difficulties of judging how to divide and into how many segments are obvious. The literature is replete with the debris of past errors in judgment, both in unsplit publications and in oversplit publications. However, it is also replete with successful exercises of these judgments.

Facing the need to divide is difficult. It is not surprising that alternative avenues, or delaying tactics, have been explored—and some found. The page charge is such an avenue. So is advertising, when available. But both have limits, since they are voluntarily made available by those who have the funds. Our projections show, though, that the ACS will not approach these limits in the next five or ten years—that is, that page charges, advertising, and subscription prices could hold our system in economic equilibrium without serious difficulty for the next decade.

In the past ten years, we have added 12 journals, only two of which, *ES&T* and *Macromolecules*, can be said to represent new areas of chemical coverage. The others are in essence or in reality separation of fields of chemistry from journals covering broader fields of chemistry.

By doing this, we seem to have stabilized our proportional service to members—that is, we continue to see 35–40% of them subscribing to journals. We seem to have found a way to cause our circle of purchasers to grow—not as rapidly as our costs grow, to be sure, but at least the trend is in the right direction.

But this factor alone does not explain our financial stability, as shown in Table V. Here, after repeating some numbers from Table IV, I have added a few facts about nonmember subscriptions. In 20 years, these have increased from 24,000 to 116,000. Even though the number of institutions where chemistry is practiced has increased, it certainly cannot possibly be greater than 30,000 in the world. The likelihood of each of these establishments needing research information is probably less than 50%.

Table V. Member vs. Nonmember Subscriptions

	1933	1948	1958	1968
Journals	3	3	7	19
% Members subscribing	100	60	35	37
Total member subscriptions	N.A.	61061	47622	86445
Total nonmember subscriptions	N.A.	23885	40193	116293
Subscriptions per member subscriber	3.0	1.7	1.5	2.1
Ratio member subscriptions to nonmember subscriptions	N.A.	2.6	1.2	0.75
Average nonmember subscriptions per journal	N.A.	8000	5700	6100

So, by breaking up our general journals into rather more specialized ones, we have not only caused those individuals who buy journals to buy slightly more (2.1 vs. 1.5 or 1.7 ten or 20 years ago), but we have greatly increased the relative significance to us of institutions, where price sensitivity is not so great as with individuals. This trend has strengthened the stability of our publishing programs and means that, so long as we publish journals of considerable scientific merit, we have a mechanism to “have our cake and eat it too”—that is, we can pay for our primary literature and yet can offer it in pieces to individuals at prices they can afford.

In conclusion, the problem of the primary literature can be stated very simply as learning when to start the next journal. That is, how to determine which segment of the chemical population is now large enough, active enough, productive enough, and funded enough to support it, and how to define its scope so that it will meet the general criteria for success that can be articulated from experience, while at the same time controlling the size of the parent journal.

Relationships between Primary Publications and Secondary Information Services*

RUSSELL J. ROWLETT, JR., FRED A. TATE, and JAMES L. WOOD
Chemical Abstracts Service, Ohio State University, Columbus, Ohio 43210

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The information distribution and accessing system which operates in the scientific and technical community is based on three distinct, but interdependent, segments: the primary publications which record the information in discrete, printed packages; the libraries which collect, organize, store, and make available the accumulated primary publications; and the secondary services, each of which pro-

vides, for a specified range of primary publications, subject-oriented access to newly available information and/or organized subject-oriented access to the accumulated information store.

For the purposes of this discussion, the information processor is defined as the organization which provides primary and/or secondary publications and services. The information user is an intermediary which collects the output of information processors. The user often generates and uses specialized systems for handling proprietary

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