Survey of Operations and Finances of Scientific Journals

Robert Tumbleson and Helen L. Brownson

National Science Foundation, Office of Scientific Information, Washington, D. C.

THE SKY-ROCKETING volume of original scientific publication and the publishing cost, which has increased even more rapidly, have created critical financial problems for some scientific journals and have been of serious concern to all. The volume of publication continues to rise. In 1951 the total number of pages in journals published by the American Institute of Physics rose 7 per cent over the previous year. The publications of the American Chemical Society report comparable increases.

Part of this rising flood of words can be considered "normal" in that the number of scientists is larger than ever before, and hence a greater output can be expected. Of still more significance is the fact that a larger proportion of scientific man-years is being drawn into research and development work because of unprecedented amounts of support for such work. Estimates of the Research and Development Board, Department of Defense, indicate that total expenditures for research and development have increased from $900 million in 1942 to $2900 million in 1952. The industrial contribution has gone from $500 million to $1200 million in this ten-year period while that of the federal government increased from $300 million to $1600 million. The university contribution has doubled—from $50 million to $100 million in the same period.

Aware of the critical nature of the problems facing the journals, the National Research Council, in February 1950, called a Conference on Primary Publication attended by representatives of many journals, scientific societies, publishing houses, and government agencies. Many ideas for reducing costs and increasing revenues were discussed. Some of these had proved highly useful in individual cases, but it was difficult to gain a clear-cut picture concerning the overall state of scientific journal publication.

In its basic legislation the National Science Foundation is authorized and directed to encourage the dissemination of scientific information. Because journals of primary publication represent a most important channel in this process, the Foundation, shortly after it was organized, began to compile data on the current status of journals. During the course of this investigation a questionnaire was distributed to a selected list of journals. It was designed to obtain facts concerning circulation, volume of original research papers published and the backlog awaiting publication, sources of revenue, and expense items. In addition, opinion was sought regarding appropriate or potential sources of additional support and the purposes for which additional funds were needed. A final question asked about the policies of journals with respect to publication levies to be paid by authors or institutions sponsoring research. This was of particular interest to a number of federal agencies that found it difficult to pay such charges when assessed against scientists in their employ or in the employ of their contractors. However, a recent decision by the Comptroller General of the United States (B-114593, May 1953) appears, in the case of most agencies, to have removed legal obstacles to the payment of part of the cost of disseminating the results of research through private scientific journals.

One hundred ten, or 54 per cent, of the two hundred five questionnaires distributed by the Foundation in this survey were returned. The response varied widely from field to field. For example, seven out of eight (88%) of the questionnaires sent to geological journals were returned, whereas only fourteen out of forty (35%) were returned in engineering. No data are included about the journals of the American Medical Association or the American Chemical Society. The circulation of journals answering the questionnaire ranged from less than 500 to more than 60,000; the average circulation was about 6000.

Approximately 71 per cent of all replies returned were from official journals of scientific societies, and about 58 per cent of subscribers in this group were society members. Approximately 50 per cent of subscribers, to journals having a circulation of 4000 or less were member subscribers, compared to 68 per cent for journals with circulations over 4000. This seems to indicate that the nonmember audience, largely institutional, for scientific periodicals is relatively fixed and that circulation depends largely on membership support, an important factor in the economics of journal publication.

On the average, this group of journals published about 900 pages of original research material annually, ranging from less than 100 pages to more than 5000 pages. Approximately seventy per cent of all papers submitted to editors are eventually published in the journals to which submitted. A considerable proportion of the remainder are turned down because they are submitted to the wrong journal.

Seventy of the one hundred journals reported a backlog of accepted but unpublished articles of less than six months; twenty-five journals had a backlog of from six months to one year, and five of a year or longer. The average backlog was 5.3 months for journals publishing five hundred pages or less per year and 1.9 months for journals publishing over 2000 pages per year.

There was also a negative correlation between the extent of the backlog in months and length of articles. The backlog was 5.6 months for journals in which the average article ran four pages or less compared to 2.1 months for journals in which the average article length was twenty pages or more. The time-consuming process of revising articles to meet space limitations may be revealed in these figures.

The replies did not indicate that a "tight" or "loose" referee policy as measured by the proportion of papers accepted had any effect on the backlog.

One section of the questionnaire was devoted to journal finances. The answers revealed considerable differences in accounting methods, particularly in connection with the distribution of costs. Cost information for eighty-two journals is summarized in Table 1.

The low editorial cost item for journals having less than 1000 circulation may be explained by the fact that the editors are in large part volunteer workers and editorial clerical help is frequently contributed by the institution employing the editor. As expected, composition is the largest production item for journals of small circulation, whereas cost of paper and press-work is more important for journals of larger circulation.

Information on the sources of present support for publications is summarized in Table 2 and shows the proportions of income received from various sources. This breakdown varies widely with circulation. Two-thirds of the income received by journals having less than 1000 subscribers comes from sale of subscriptions and society contributions in lieu of member subscriptions. This falls to 45 per cent for journals having circulations of 8000 or more. The journals with small circulations receive insignificant revenues from advertising, but in the case of journals having circulations of 8000 or more, advertising revenue makes up more than half of the total income. In the table, income from sale of reprints and author contributions are lumped together, as the authors or their institutions normally are the largest purchasers of reprints.

TABLE 1. Distribution of costs for scientific publications.

Cost item	Circulation (%)		
	Less than 1000	1000 to 7999	Over 8000
Editorial expense	1.9	10.9	10.8
Administrative overhead	16.2	12.1	7.5
Composition and engraving	60.6	30.1	24.7
Printing and binding	10.9	19.0	13.7
Paper	7.1	10.7	18.8
Mailing	1.1	4.1	8.2
Circulation promotion	0.1	1.3	1.9
Advertising promotion	—	1.3	6.2
Other	0.7	3.0	5.8
Surplus	1.5	7.4	2.5
Total	100.0	100.0	100.0

TABLE 2. Sources of income of scientific publications.

Source of income	Circulation (%)		
	Less than 1000	1000 to 7999	Over 8000
Subscriptions and society contribution in lieu of subscriptions	67.2	69.8	45.2
Other sales income	12.1	5.1	0.8
Reprint income and payments from authors	16.0	7.0	2.5
Advertising revenue	0.7	14.2	51.5
Support from private foundations	2.3	3.2	—
Other	1.7	0.7	—
Total, all sources	100.0	100.0	100.0

Respondents were asked where they believed additional financial support could most appropriately be obtained. Forty-six editors out of ninety-four who answered suggested "more advertising" as a source of additional revenue. Editors of smaller journals realize that this is an unlikely source of funds, however, since only 23 per cent of the editors of journals with a circulation of 1000 or less checked this as against 51 per cent for journals having circulations of 1000 to 7999, and 82 per cent for journals with circulations of 8000 or more.

About half of the replies suggested that additional support should be obtained from a society or private foundation or both. Only one out of six thought direct support from the government desirable, and only one out of eight proposed direct support from industry, other than advertising.

Slightly fewer than one-third suggested "higher subscription rates" as a possible source of additional income, 20 per cent checked "higher reprint charges," and 28 per cent proposed a page charge to be paid by the author or institution supporting the research. Seventeen out of ninety-four editors (18%) proposed consolidation of related journals as a potential source of added income or reduced costs.

Thirty-six of the ninety-four replies suggested that further editorial or production economies could be achieved; twenty-five of the thirty-six proposed shorter articles as a specific method for doing this. Opinion on the desirability of running shorter articles varied significantly with the length of articles now appearing in the respondents' journals. Thirty-five per cent of the replies from journals in which articles now average less than ten pages in length proposed shorter articles, compared to only 13 per cent for journals running articles of ten pages or more.

About 30 per cent of the replies checked "better promotion" as a method for increasing income. This varied with circulation: 8 per cent in the case of jour-

nals having less than 1000 subscribers, 31 per cent for those having more than 1000 but less than 8000, and 45 per cent for those having 8000 or more.

A question was added to the questionnaire asking about the effect of lack of funds upon the scientific usefulness of the journal. Replies were compared with reported data on number of pages, length of article, backlog, and percentage of acceptances. No meaningful relationships could be discovered. For example, some of the editors who indicated that financial difficulties had had no effect upon the scientific usefulness of their journals reported backlogs of unpublished articles ranging from ten to twenty-one months, while the editors who indicated that the scientific usefulness had been seriously impaired by lack of funds reported backlogs of 3.6 to 6.4 months. Other factors were equally difficult to interpret.

The questionnaire asked about the use to which editors would put additional funds if available. Eighty-four per cent of all replies to this question indicated that additional funds would be used for additional pages; 43 per cent would use additional funds to increase the speed of publication; and about 30 per cent for the publication of longer articles. Half of the editors would use additional funds for improved editorial help and about one-fourth for improved format.

The pattern of response was interesting. The desire for better editorial help increased with circulation—from 14 per cent for journals having a circulation of less than 1000 to 77 per cent for journals of 8000 or more subscribers. A trend in the opposite direction was true among those desiring more funds to increase the speed of publication—71 per cent for small circulation journals and 23 per cent for large circulation journals.

Approximately 40 per cent of the journals accepting 70 per cent or more of submitted papers would use additional funds for longer articles, compared with only 15 per cent for journals having a higher turn-down rate.

Sixteen journals in the group surveyed now require payment of a publication fee by the author or his institution based upon the number of pages printed. An additional eleven journals require payment for excess pages on very long articles, and twenty-six journals require payment for plates and tables. In two or three cases payment is not required normally, but if the author assumes publication costs his article appears immediately.

The author or institution is generally billed at the time of publication, but in some instances a less direct system is employed. The American Mathematical Society, for example, utilizes a system of institutional members whose dues are based upon the average number of published pages originating in the institution in previous years.

Eleven of the sixteen journals which make publication charges gave an analyses of revenues so that it is possible to estimate the proportion of total income received from authors or institutions supporting research. The income breakdown for these journals is as follows: subscriptions and society contributions in lieu of subscriptions, 69.5 per cent; other sales income, 6.0 per cent; reprint income, 3.6 per cent; payments from authors, 12.4 per cent; advertising revenue, 5.7 per cent; other 2.9 per cent.

Thus, about one dollar out of eight of total revenues is derived from publication charges. One journal obtains 34 per cent of its revenue in this way, 6 from 10 to 19 per cent, and the remaining 4 receive less than 10 per cent.

The Foundation also distributed a brief questionnaire to a number of industrial laboratories and research institutions and private research foundations to learn their policies regarding payment of publication charges. Eight of the twelve industrial laboratories and institutes pay such charges if requested. The remaining four have apparently received no requests for payment; one expressed opposition to payment, and one appeared willing to consider such assistance to the journals if it were shown to be needed. Four of the eight private foundations queried now pay such charges upon request. The remainder have had no requests for payment, although one indicated it would probably be willing to pay such charges if asked. All twelve of the industrial laboratories and institutes and three of the foundations buy reprints; eight of the industrial group buy advertising and six maintain institutional society memberships.

As mentioned above, 26 replies out of 94 approved a publication charge as an appropriate method for increasing journal revenues. Of these, seven now make such a charge, nine charge for excess pages or plates, and ten make no charges of any kind. It is interesting to note that more than half of the journals which make a publication charge did not list this as a possible method for increasing income.

In summary, then, it would appear that the scientific journals covered by the survey are managing to publish most of the material submitted within a reasonable period. On the whole, editors dislike the idea of direct subsidy from any source, including the federal government. Although one out of four believes that a publication charge is an appropriate method for getting funds, a considerably larger proportion believe that additional income should be obtained from the society membership or industrial advertising.

The comments made by many of the editors were revealing and brought out additional points that the questionnaire overlooked. In particular, several editors called attention to the large number of articles that are badly written, repetitious, over long, and in which the presentation of scientific material was confused even where reported results and techniques appear to be sound. This creates difficult editorial problems and contributes to the cost and delay in publication.