The PUBLICATION CHARGE PLAN in Physics Journals

For more than three decades, research institutions have shared part of the expense of publishing the results of the physics research they have sponsored. The author of this article, now an administrative consultant to the American Institute of Physics, served as the director of the AIP from 1931 until his retirement in 1957.

By **Henry A. Barton**

UNDER the "publication-charge plans" of most American physics journals, income needed to meet publishing expense is derived not only from subscription and dues payments, but also from a charge against authors' institutions at a fixed rate per page. The charge is not obligatory, editorial acceptance of articles being unaffected by its payment or nonpayment, but nearly all institutions, companies, and agencies supporting research have accepted the moral obligation of meeting it.

Inception of the Plan

At the end of the 1920's the difficult problem of financing publication of *The Physical Review* was engaging most of the attention of the officers and Council of the American Physical Society. Deficits that had been incurred had been made up by timely grants, but the sources of such grants could not be tapped repeatedly. The volume of research reports requiring publication was increasing steadily and printing costs were rising. Dues and subscription rates had been increased, but this process could not be continued—particularly in the depression years—without risking so great a decline in members and subscribers that the total income would be reduced rather than raised. In a periodical of such small circulation, the sale of advertising space could offer only feeble help. The revenue of a page of advertising would pay for the printing only of itself and perhaps two pages of text.

What to do was the question assigned to a committee whose members were K. T. Compton, A. W. Hull, A. L. Loomis, and G. B. Pegram. Drastically new recourses had to be found. Naturally the possibility of more economical publishing was explored, and it was partly out of this study that the incentive came for the later establishment of the American Institute of Physics. The Committee also sought increased income. That was when the idea of a publication charge was born. The Committee made its recommendation, and on February 21, 1930, the Council of the American Physical Society voted:

1. That it is the sense of the Council that institutions supporting research can justly be asked to bear, as a proper part of the expense of such research, a portion of the cost of the publication of results in *The Physical Review*.
2. And that accordingly, *The Physical Review* is authorized to send a memorandum bill of $2 per page to the author of each paper appearing in *The Physical Review* beginning with the July 1, 1930, number, and also to furnish to each author, without additional charge, 100 off-prints of his article (without cover).
3. And that with the memorandum bill, *The Physical Review* shall send a statement to the author that the charge of $2 per page for his paper is not against him personally, but that he is to present it to the institution supporting his research with the statement of the circumstances and a request that the bill be paid.
4. And that *The Physical Review* shall further inform the author that an anonymous friend, of *The Physical Review* has, for a period of two years, underwritten this plan, and will himself pay the charge of $2 per page in each case in which the institution supporting the research is not in a position to make the payment, and that therefore, the author is requested promptly to notify *The Physical Review* as to the intention of his institution in respect to this charge.

The minutes of the Council revealed that a much higher rate ($6 or $7 rather than $2) was discussed and felt to be justified, but it was agreed that $2 was about all that would be acceptable in the beginning of so revolutionary a procedure.

Parenthetically, it should be recorded that the originators of the plan subsequently learned that the American Mathematical Society had already established a class of "Institutional Members", mostly universities and colleges, which paid dues corresponding to the average publishing activity of their departments of mathematics. Here the principle was much the same, but the mechanism was less explicit and precise than the physics plan.

Rationale

In justifying the plan to the physics community—whose sympathy and cooperative attitude stand as a shining monument in the history of physics—the Society's Council, officers, and editor made the following points:

1. No research can be considered complete until the results are a matter of record. From this point of view, publication is as much a part of research as any other mechanical feature of it. Those who support research therefore may with justice be asked to aid in its publication.
2. In a sense a journal which publishes the results of research serves not only the reader but also the author and his institution, aiding in their advancement and recognition.
3. Money spent by many institutions to send out numerous reprints of research reports would be more effectively employed in supporting recognized journals; the economical practice of sending *lists* of available reprints, rather than reprints themselves, was also suggested.

Some years later, in a generalization of this last point, the concept of the journals as cooperative media was stated. A comparison was made with a hypothetical situation in which research results were disseminated by publication in separate form at all the localities of research, each institution paying the cost of printing and mailing its own contributions. By contrast our present system affords each paper cheaper printing and distribution (even with a high page charge), wider circulation to an interested group, greater immediate and continuing availability through libraries and abstracting services, and finally the prestige accorded by acceptance in a journal of high editorial standards under the auspices of an authoritative society in the field.

Relationship To Publishing Costs

Furthermore, the page-charge concept has turned out to be peculiarly apt when the special nature and economics of the publishing process are taken into account, especially in a period of rapidly expanding volume and rising costs. This is because publishing costs fall naturally under two heads, "editorial work and composition" and "printing and distribution." Editorial work and composition includes everything that has to be done with the material to be published until the printing presses begin to roll. Printing and distribution includes everything else and is concerned with getting copies to subscribers.

The first category includes editing, refereeing, preparation of manuscripts for the printer, type-setting, engraving of illustrations, proof-correcting, indexing, and making the type ready on the bed of the press. It will be noted that the amount of work and cost of every one of these steps are proportional to the number of pages to be published and quite independent of the number of copies to be run.

The second category includes paper and press-run, folding, gathering, binding, covering, wrapping, transportation to the post office, and postage. It also includes billing subscribers, accounting, maintenance of mailing lists and addressing. All of the items in the second category are proportional to the number of subscribers. In the case of presswork and paper, of course, the factor of proportionality rises with the number of pages.

An excellent fitting of publication income to publication costs could be made by adjusting the page charges to cover the costs of editorial work and composition and adjusting the subscription rates to cover the cost of printing and distribution. No matter how the amount of material to be published might then fluctuate, the cost and income for the editorial and composition work would remain in balance. The subscription rate obviously would have to rise with (but not in proportion to) the annual number of pages in a journal.

Under this philosophy the subscriber would be charged the per-capita printing and distribution cost. It might be said that once the text is on the press it is in the public domain, and anyone who wants his personal set of copies simply pays the cost of running them off and sending them. If the growing use of photocopying should cut down circulation, it would not matter financially—except, of course, for journals which sell advertising space. To sum up, such a division of publishing costs between the "producers" and "consumers" of scientific reports could provide reasonably good financial stability despite fluctuations in pages or subscribers. Such an ideal allocation of costs does not exist in practice, and allowance has to be made for the fact that payment of page charges, which is voluntary, falls below 100%. However, this kind of division is now being approximated in the journals of the Institute. Admittedly the publication-charge plan is no panacea against inflation in the general economy, but the existence of the procedure has helped the physics journals to cope with the problems of inflation.

Initial Operation of the Plan

In accordance with the Council resolutions cited earlier, *The Physical Review* began making the charge of $2 per page against all contributed research reports. One hundred "free" reprints were provided as a partial tangible return, a practice which incidentally pro-

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vided an expedient in some departments and agencies where funds were not available "for publishing" but were available to "buy" reprints. The anonymous donor referred to by the Council of the Physical Society did indeed pay the charge when the institution did not. This not only gave *The Physical Review* a needed quick shot in the arm. It also applied successfully a kind of moral suasion on institutions to be among those who honored the charge on their own.

After the plan had been in effect for a little over a year, the American Institute of Physics was established. At a meeting of the Governing Board, May 21, 1931, Dr. John T. Tate, editor of *The Physical Review* and advisor on publications of the AIP, reported that in the first year, "76% of the bills were paid." In view of this surprisingly successful initial record, he went on to recommend "That the Governing Board of the American Institute of Physics suggest to the cooperating societies the desirability of their adopting a uniform policy in regard to charges made to institutions supporting the researches published in their journals." He recommended further "That, in case the cooperating societies agreed to this plan, the Governing Board of the Institute inform the Rockefeller Foundation of the decision of the cooperating societies and inquire whether the Foundation would not be willing, in view of its own interest in such a method of securing partial support of scholarly publications, to underwrite the plan to the extent of guaranteeing for a definite period of years payments of bills returned from the institutions marked 'no funds'."

This recommendation met a favorable response from both the Rockefeller Foundation and the Societies. At that time foundations were besieged for grants to needy journals but were reported to feel that such grants would only give temporary help leading to no long-term solution of the problem of financing scholarly publications. Here, by contrast, was a proposal which would generate a new and continuing form of income. Starting July 1, 1932, the Foundation gave the AIP funds to underwrite on a descending scale page charges up to $6000 for the first twelve months, $5000 the second, etc., to a final period of $1000 ending June 30, 1938. (Actually $1000 for a seventh year was also provided.) The Rockefeller Foundation's implied endorsement of the plan was perhaps as valuable as the grants. It certainly helped to gain acceptance in the institutions to which the page-charge bills were sent. Indeed the cooperation of the latter was so effective that of the Foundation's grants totaling $22 000 there was an unused residue of $4 388.43.

By action of the cooperating Societies, the journal *Physics,* later to become the *Journal of Applied Physics,* and also the *Journal of the Acoustical Society,* joined *The Physical Review* in adopting the plan, as of July 1932 issues. *The Review of Scientific Instruments* and the *Journal of the Optical Society* began making charges in their October 1932 issues.

It is to be noted that these actions were taken before the AIP became the publishing agency of the So-

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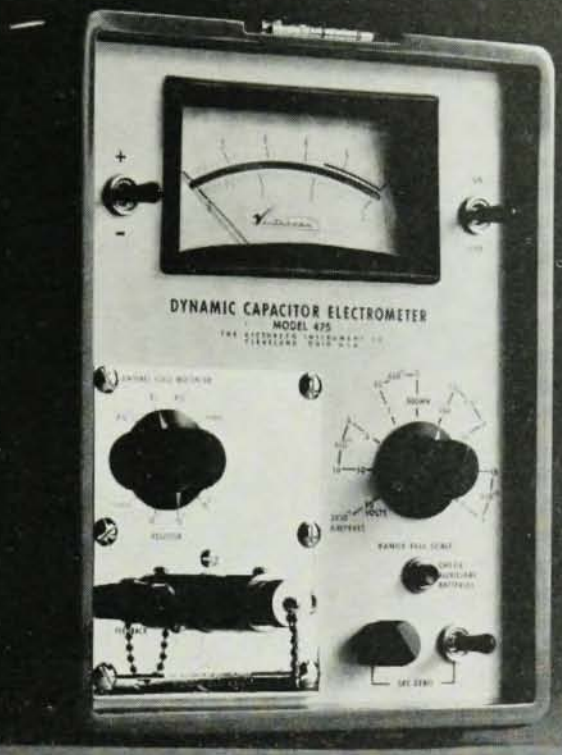

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cieties in late 1932 and 1933. When, in 1933, all of the journals were joined in a unified publishing scheme, a larger standard page size was adopted and the publication charge was raised to $3 per page.

At this time another principle of the page-charge procedure was evolved, namely, that papers *invited* by the editors were exempt, the charge being restricted to voluntarily contributed reports. Consequently the entire contents of *Reviews of Modern Physics*, as well as portions of some other journals, produced no income from this source. The same is true, of course, of cover pages, tables of contents, indexes, society proceedings, minutes, and the like. One cannot "audit" the page-charge income by multiplying the last page number in a volume by the rate per page!

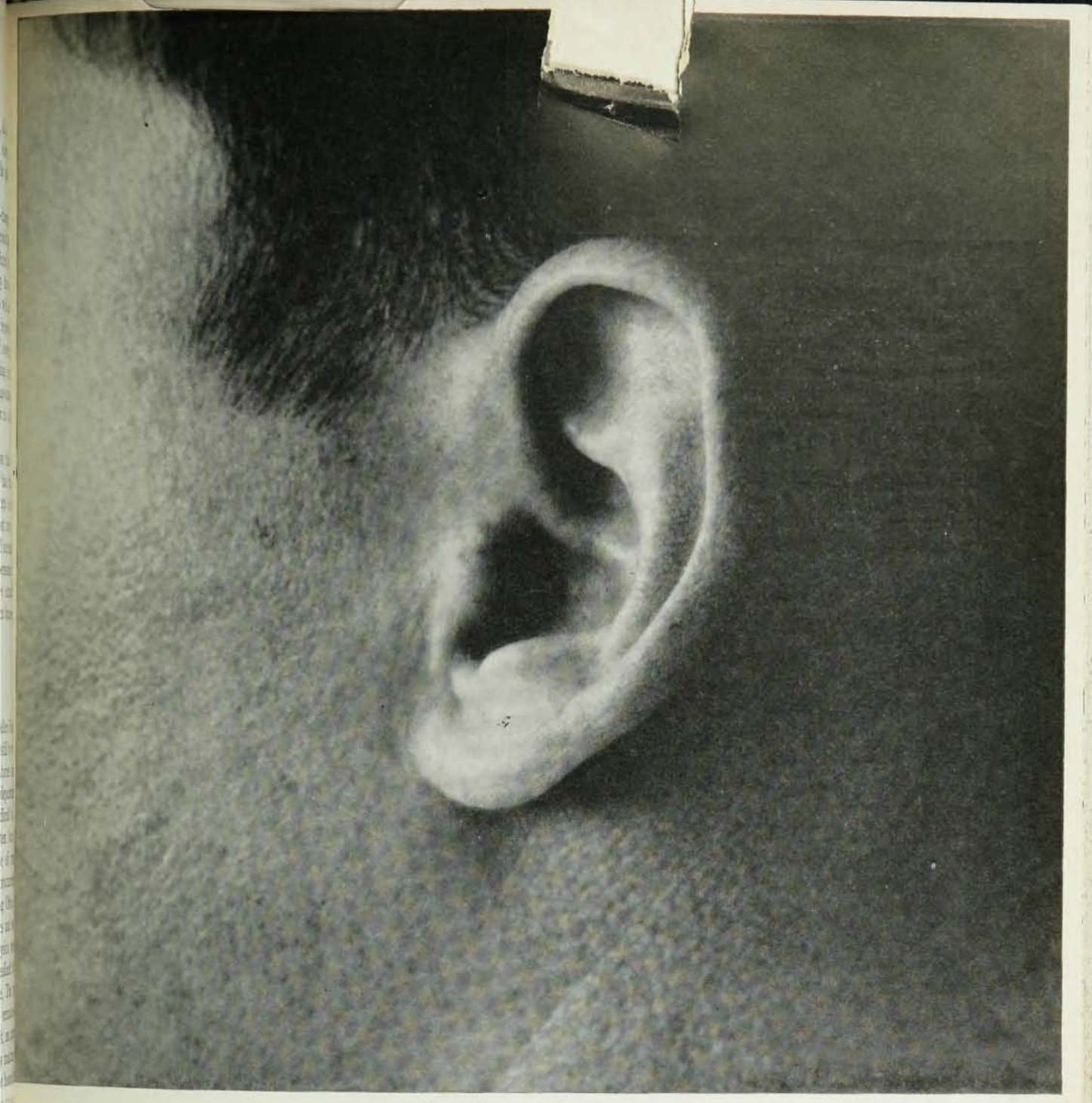
It should also be emphasized that from the outset, payment or nonpayment of the charge has made no difference in the editorial decision to accept or not accept an article. This is really true without any qualifications whatever. In fact, the billing and accounting of charges have been handled by clerical personnel in the Institute's office, and the editors have actually not known whether or not charges have been honored.

Subsequent Development

At the end of the period of Rockefeller Foundation underwriting, the page-charge plan was still by no means universally accepted. Industrial laboratories nearly all honored the charge and most physics departments did. Many government agencies found it difficult to pay the charge for various reasons, most often because this could be interpreted as the purchase of printing in violation of legislation confining such procurement ordinarily to the US Government Printing Office. Articles coming from outside the United States and some from academic departments other than physics were generally not covered. The amount of unrealized income on this account was far from negligible. The price was kept at $3 per page nevertheless and remained at that level for 14 years. Rather than raise it, an attempt was made to offset the missing revenue by making a higher price for reprints to those who did not honor the publication charge. Using as an example a six-page article, the two sets of prices in 1939 were:

Quantity of Reprints	*If Publication Charge Honored*	*If Not Honored*
100	Free	16.00
200	$3.80	19.80
Additional 100's	2.20	2.20

At the prevailing low level of page charges, this provided a fair sharing of publication costs by those who did not pay page charges. As the journals grew in size



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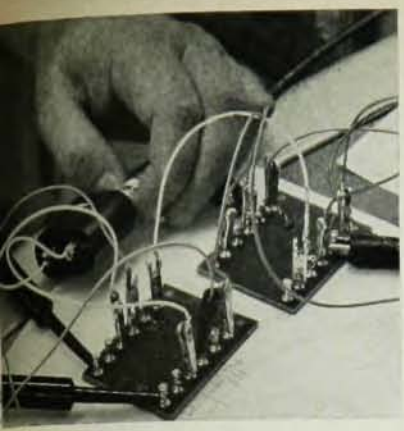
and printing costs went up, it became necessary to increase the scale of page charges. It then became impossible to set a compensatory reprint price scale which was not absurdly exhorbitant when compared with prices of reprints from journals outside of physics. Thereafter the only thing to do was to work for the widest possible acceptance of the principle of the page charge itself. This was necessary anyway or increases in the page rate would not have been feasible.

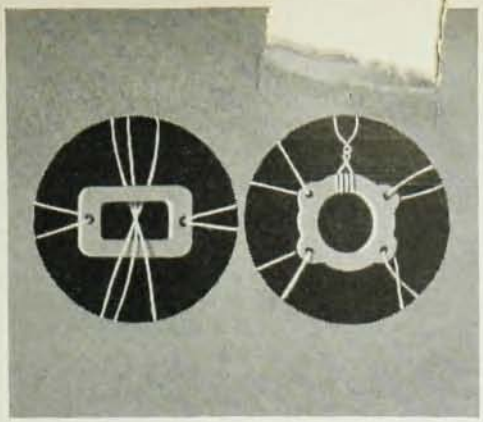
Within the physics community a general understanding of the financial needs of the journals, reinforced by explanations and exhortations from society councils as rate raises were made, proved sufficient to keep up or even augment the percentage of pages for which charges were honored. Since the page-charge system was not used until this year (1963) by the American Chemical Society, there was a special problem with papers, of which there were naturally a large number in *The Journal of Chemical Physics*, coming from chemistry departments. A number of personal explanatory letters, written by friends of the journal to appropriate department heads, were effective in improving the honoring of the publication charges.

Nevertheless, after the rate was raised to $4 per page in 1947, it was felt that an attempt had to be made to convince those in other fields of science that the page-charge plan would be good for their journals and to urge that government agencies be given the needed authority to pay publication charges and to allow their contractors to do likewise.

In January 1949, the AIP proposed that the National Research Council call a conference on problems of financing scientific journals. With the active participation of Dr. R. C. Gibbs, Chairman of the Division of Physical Sciences, a Conference on Primary Publication was held February 11 and 12, 1950, at the National Academy of Sciences in Washington. Sponsored by the National Research Council and presided over by Dr. Detlev W. Bronk, Chairman of the Council, it was attended by editors of journals and officers of societies in most fields of science. Although the meeting dealt with a broad range of topics, the plan of levying a charge on a per-page basis was discussed at considerable length. There was much interest in the experience of the physics journals in this respect.

The conference was also attended by representatives of the various government agencies conducting or supporting scientific research. The possibility of large and continuing government subsidy of scientific publications was being widely discussed at that time, and naturally so because the greatly increased government outlays for research work were mainly responsible for the increased load on the journals. The conference led to further consideration by government agencies. Such agencies compared their views in sessions of the Interdepartmental Committee for Scientific Research and Development. The Committee established a panel to give careful study to the matter of government financial aid to journals of scientific research. After consideration of the legislative background and a ruling of





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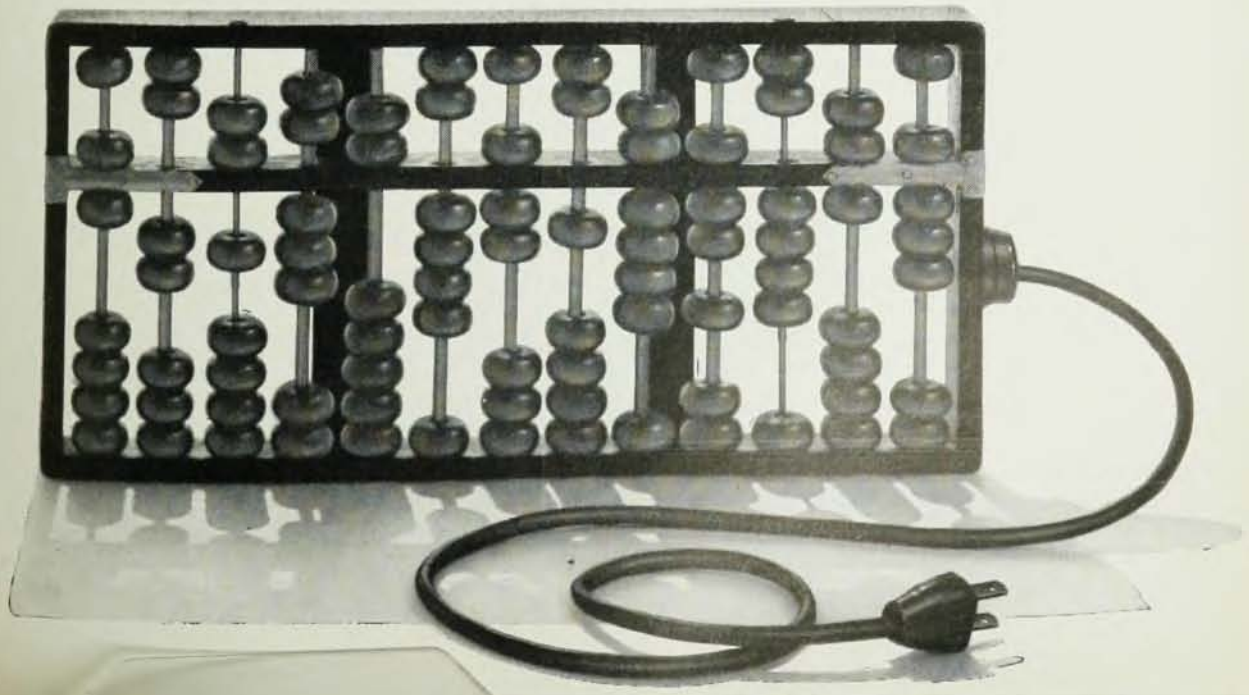

the Comptroller General dated May 5, 1955, the panel recommended and the Committee accepted a statement addressed to government research agencies. The statement agreed that publication costs should be regarded as a part of research costs, maintained that what had appeared to be legal obstacles in the way of paying page charges were not really valid, called attention to existing favorable policies in the Atomic Energy Commission, the National Science Foundation, and the Public Health Service and suggested that such payments should only be made to journals not operated for profit which customarily make the same charges to nongovernment as to government-sponsored articles.

Although certain agencies had already translated such a policy into operating procedures, certain others had to await clear legislative and regulatory enabling actions. The National Science Foundation took an active part in this movement, and an extension of the idea enabled contractors as well as agencies to pay publication charges. This included contractors of the Defense Department under uniform policies adopted by these departments in 1955 and 1956 and stated in official instructions.

Finally, an action to confirm and standardize the procedure for all departments of the government was taken by the Federal Council for Science and Technology and announced to the press by the NSF October 25, 1961. Specifically, this action allowed the budgeting and payment of page charges under federal research grants and contracts. The Council established four criteria for honoring such page charges, namely:

1. The research papers report work supported by the government.
2. The charges are levied impartially on all research papers published by the journal, whether by nongovernment or government authors.
3. Payment of such charges is in no sense a condition for acceptance of manuscripts for the journal.
4. The journals involved are not operated for profit.

Among many persons whose interest and initiative helped shape the policies and procedures of the government, mention should especially be made of Dr. Allen V. Astin, director of the National Bureau of Standards, and, for a term, chairman of the Interdepartmental Committee for Scientific Research and Development, and of Dr. Burton W. Adkinson, head of the Office of Science Information Services of the National Science Foundation, and members of the staff of that Office.

Recent Developments

As the volume of research, and consequently of published reports, has grown at an accelerating rate in recent years, those councils and officers responsible for the financial health of the physics journals have found it necessary to increase the rate per page of the publication charge. Pressed by this growth and by the simultaneous rise of printing and other costs, they have

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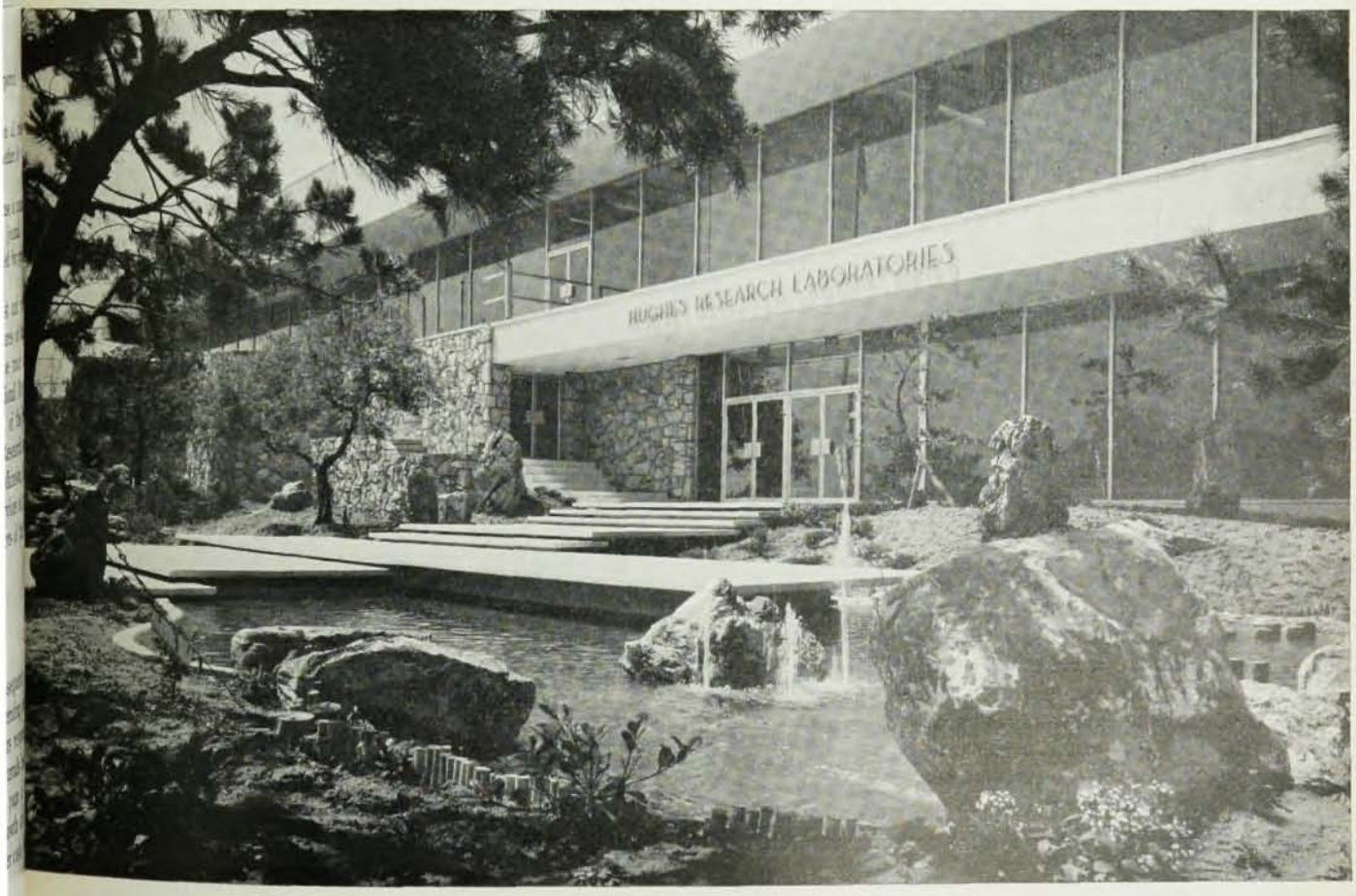

in effect come closer to charging the economically advantageous full editorial and composition cost per page. They have made this decision not without reluctance but with an awareness that, in the case of a large fraction of the articles, support is now available from contracting agencies. As a consequence, the gross publication-charge income of the physics journals now meets a sizable fraction of the total cost of publishing these journals. Of the journals published by the Institute for itself and its five Member Societies in 1961, ten made the charge for contributed articles. In that year, the charge brought in 35.9% of their total publishing cost. Parenthetically, it should be explained that a part of this gross income must be credited toward the furnishing of reprints, but the net available toward the original publishing cost of the journals is not far below the gross.

Because of differing circumstances, the range of the percentages between the individual journals was rather large. One would expect, for example, that the percentage would be relatively high for journals of many pages and small circulation. Differences in the proportion of chargeable material to the total contents also affect this percentage. In 1961 the fraction of total publication cost met by publication charges ran from 23.0% for the *American Journal of Physics* to 44.5% for *The Journal of Chemical Physics*. The figure for *The Physical Review* was 43.1%. These last two journals are, of course, mainly devoted to research reports.

Appendix I records the history of actual page-charge rates for twelve Institute and Society owned journals now using this procedure. As will be seen from the table of charges for the several journals and the years in which these were inaugurated, the charges did not rise for a number of years after they were first invoked (and then adjusted to a larger page size) but remained at a nominal level as compared with the costs actually incurred in bringing a page to the press. It was not until after the second world war when inflationary pressures became serious that the rates had to be raised. The more rapid subsequent rise represents an attempt to make the charge of the same order of magnitude as the "editorial and composition" cost per page, which in turn has risen through the years.

Early in the history of the page charge, an attempt was made to compare the rate per page with the average total cost to institutions and laboratories of carrying out the research reported therein. The conclusion reached was that the publication charge amounted to something of the order of 1% of the total. More recently another rough check of this ratio has been made on the basis of national figures for the amount of money spent on basic scientific research. As in the earlier estimate, some assumptions had to be made—for example, the fraction of all basic research which is in physics and is represented by reports in the physics journals—but the conclusion again seemed justified that 1% was about the right order of magnitude. This suggests that, within the broad limits of accuracy of these estimates, the average total cost of research per published page has risen about as fast as the publication charge per page. It is apparently still true that, in accepting the publication charge, the institution sponsoring the research is adding to its costs not more than about 1% to distribute the results to the scientific world. In many instances it is much less than this.

Appendix II summarizes an analysis of publication page charge honoring, taking the year 1960 as a representative example. During that year, ten physics journals contained 20 921.05 pages for which the charge should have been honored. For 17 609.40 pages or 84.17% it was honored. For *The Physical Review* the corresponding figure was 92.29%.

The principle of making a publication charge on the basis of the number of pages in an article has recently gained considerable headway in other fields of science than physics. This is not a new thing in mathematics, psychology, and meteorology. Perhaps a dozen biological journals are now making the charge. Eight of the journals published by the American Chemical Society have inaugurated the procedure as of January 1963.

Since the policy of the federal government toward the problem of financing the publication of government-supported scientific research is based on the assumption that existing journals of the scientific societies either do or can make use of the page-charge procedure, it is probable that rising volume and rising costs will necessitate adoption of the practice by many more journals in the near future.

The most recent development of the principle of the page charge has been its extension to include partial support for abstracting and indexing. These are essential parts of the process of research-plus-communication to make results fully available to other scientists. The principal English-language indexing and abstracting service for physics, which has been supported in part for many years by the American Physical Society, is *Physics Abstracts*, which is Section A of *Science Abstracts*, published in London by the Institution of Electrical Engineers. Beginning with January 1963, an abstract charge of $10 per article will be added to the page charge for articles published by the American Institute of Physics for itself and for the Member Societies. The proceeds will be transmitted to *Physics Abstracts*. It is anticipated that this voluntary contribution will be accepted by a very high percentage of institutions supporting research, as has been the case with page charges.

This latest procedure is the first international functioning of the principle of the page charge except for such page charges as have been paid in the past by the individual research institutions of foreign authors publishing in American physics journals. Whether the next step will be the adoption of page charges for the benefit of physics and other scientific journals in countries other than the United States remains to be seen. Labor costs are rising rapidly, at least in western Europe, so it may not be long before problems similar to those of American journals may necessitate the adoption of similar solutions.

Appendix 1. Record of Page Charge Rates

(Showing for each journal year during which indicated rate was first effective)

Year	*Phys. Rev.*	*Phys. Rev. Letters*	*J. Opt. Soc. Am.*	*J. Acoust. Soc. Am.*	*Am. J. Phys.*	*Rev. Sci. Instr.*	*J. Appl. Phys.*	*Appl. Phys. Letters*	*J. Chem. Phys.*	*Phys. Fluids*	*J. Math. Phys.*	*Astron. Journ.*
1932	$2		$2	$2		$2	$2					
1933	$3		$3	$3		$3	$3		$3			
1934					$3							

(After the change from $2 to $3 for a larger page size, no further changes were made until the period of post-war inflation)

1947	$4		$4	$4	$4	$4	$4		$4			
1950	$8		$8	$8		$8	$8		$8			
1951												
1952	$15								$15			
1953				$15								
1954												
1955												
1956	$25				$6	$15	$15		$25			
1957												
1958		$25	$15	$25		$25				$25		
1959	$30	$30			$12		$25		$30			
		$35										
1960			$25				$30				$25	
1961					$25	$30				$30		$25
1962	$40	$45		$40		$40	$40	$45	$40	$40	$40	
1963	$50	$50				$50	$50	$50	$50	$50	$50	

Notes: The *Astronomical Journal* charged $15 when it began publication through the AIP in 1960. The *Journal of the Acoustical Society* also offered a voluntary higher rate ($20) 1946–49.

Appendix 2. Analysis of Page-Charge Honoring—1960

Journal	*Chargeable Pages*[1]	*Pages for which the Charge was Honored*	%
Phys. Rev.	7 649.30	7 059.90	92.29
Phys. Rev. Letters	860.60	779.60	90.59
J. Opt. Soc. Am.	1 180.20	827.30	70.10
J. Acoust. Soc. Am.	1 333.20	919.60	68.98
Am. J. Phys.	737.40	586.40	79.52
Rev. Sci. Instr.	1 220.70	1 039.90	85.19
J. Appl. Phys.	2 575.10	2 283.50	88.68
J. Chem. Phys.	3 802.55	2 888.95	75.97
Phys. Fluids	1 036.00	815.25	78.69
J. Math. Phys.	526.00	409.00	77.76
All these	20 921.05	17 609.40	84.17

[1] Pages (and fractions thereof) included in contributed articles, excluding pages devoted to tables of contents, indexes, minutes of meetings, abstracts of papers delivered at meetings, cover pages, etc., and excluding pages of review articles and other material invited by the editor for which no charge is made.