Mathematical Literature

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THE GROWTH OF THE mathematical literature is one of the principal topics of this article, since the question of growth affects directly some of the matters to be discussed; hence it is not inappropriate to make some preliminary remarks on the topic. It is always an unenviable task to make a quantitative prediction of future developments, and the present undertaking carries more than its share of hazards because of what the author believes to be misconceptions and miscalculations concerning the growth of the mathematical literature. To understand how the present conclusions concerning the growth are drawn, the function and the operations of *Mathematical Reviews (MR)* will be described, and data will be given to estimate quantitatively the growth of the literature. The operations and functions of other reviewing and abstracting services will be described, with some emphasis on the Soviet mathematical literature. Other reference material of interest to the professional mathematician and the status of the so-called "unpublished literature" will also be discussed.

Mathematical Reviews. MR is an international journal sponsored by the American Mathematical Society, the Mathematical Association of America, Institute of Mathematical Statistics, Edinburgh Mathematical Society, Société Mathématique de France, Dansk Matematisk Forening, Het Wiskundig Genootschap te Amsterdam, London Mathematical Society, Polskie Towarzystwo Matematyczne, Unión Mathemática Argentina, Indian Mathematical Society, Unione Matematica Italiana, and Society for Industrial and Applied Mathematics; it is published by the American Mathematical Society, and the deficit in its cost of publication is carried by the National Science Foundation. The purpose of the journal is to provide, as far as possible, authoritative and critical reviews of *all* literature of substantial mathematical content. The reviews may be written in any one of the four official

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languages (English, French, German and Italian), and the reviewing staff is formed of active mathematicians from almost every country in the world; there are fifteen Soviet reviewers and two mainland Chinese, for example. Because of its coverage and bibliographical authority, *MR* has become the leading reference work for contemporary mathematics; because its importance and influence will increase significantly in the future, its function and operation will be described in detail.

The reviews in *MR* are intended chiefly for professional mathematicians; textbooks below the graduate level are not usually mentioned, although there are exceptions. In each monthly issue the reviews are arranged by subject matter so that the working mathematician, who must be kept informed of the results of work published by other mathematicians, can determine those articles or books which are of interest to him. (It may be interesting to note here that one of the most useful features of *MR* to the professional mathematician is the information in a review that a certain article or book is *not* of interest to him, despite a possibly relevant title, and need not be tracked down.) The purpose of such a reviewing journal is best fulfilled if the coverage is as complete as possible and if the review itself is detailed enough so that the essential content of the article is revealed.

The coverage of the world's literature by *MR* is about as complete as it can be, for *MR* is an extremely negotiable instrument of exchange. The editor of *MR* maintains intimate exchange relationships with foreign institutes and publishers. In the case of the Soviet Union, for example, an exchange has been set up with the Academy of Sciences of each of the autonomous republics; the relationship and cooperation have now developed to the extent that new journals and other literature are sent to *MR* immediately upon publication. Experience has proved the diversified relationships to be far superior to a centralized exchange arrangement, which tended to become inflexibly bureaucratic; the individual academies appreciate the personal attention and are willing to scour the Soviet Union for particular items needed for reviewing purposes. It may be of interest to point out here that Soviet literature—books, periodicals, etc.—is produced in a predetermined print order, and that when the print order is exhausted, the literature is out of print and difficult to obtain. There are available periodicals describing the Soviet literature currently in production, along with the print size and approximate appearance; the most comprehensive of these periodicals are *Novye Knigi SSSR* (Moscow, 1956–), *Knizhnaya Letopis* (Moscow, 1907–), and *Novye Knigi za Rubezhom* (Moscow, 1957–).

The choice of reviewer for a particular paper is made by the editor on the basis of subject matter, ability to read the language in which the paper is written, the reviewer's possible interest in the paper, and the editor's belief that the reviewer can write a competent and objective review of the paper. Since most active mathematicians are—or have been—reviewers for *MR,* and since the editor has, in almost every instance, been an active member of the mathematical community, the present form of the *MR* reflects rather accurately what the American and international mathematical community wants it to be. Because of the international character of mathematics, it is no coincidence that the Soviet reviewing journal, which will be discussed below, follows almost the same format and style as *MR.* The reader expects that the review should offer, whenever necessary, more information than that included in the original paper, pointing out related references, mistakes, faulty results, and occasional plagiarism.

The timeliness of the review is an important factor if *MR* is to be of maximum usefulness to the mathematical community. In 1962 arrangements were made with the editors of the major journals of Europe, Japan and America to send corrected page proofs to *MR* for review; this meant that reviews could be sent to the printer one to six months before the actual publication of the article, so that reviews were frequently published before the papers. Such page proof arrangements did not seem practicable with Soviet journals; however, twelve major Soviet journals are dispatched by air mail from the Soviet Union immediately upon publication so that reviews of papers from these core journals may appear within two or three months of their receipt in American libraries.

The Growth of Mathematical Literature. Any discussion of the growth of scientific literature inevitably begins with some expression of awe and concern with respect to the rate of growth. Typical of today's jargon are the words "exponential growth":

> Difficulty in keeping in touch with what has been published has been present in all fields of science and technology for centuries. Exponential growth of the literature has forced innovation after innovation. Growth continues exponentially, and innovation must continue.[1]

For those to whom the term "exponential growth" is too technical, the expression "information flood" will evoke an intuitive feeling of the problem:

> The information flood so characteristic of technology today is very evident in mathematics where the number of mathematical journals and books is rapidly increasing. The establishment of new journals is no doubt stimulated by the extraordinary increase in productive research in mathematics since the war. Some attribute this burgeoning of journals to the greater competences of university faculties and more support of research by government and industry, but others suggest that promotions in universities and industry, election to society offices, contract renewals and similar benefits have been intimately tied to publications.[2]

Now the editor of *MR* has a more difficult task than the editor of a primary journal in planning his budget for two or three years ahead, for the editor of a primary journal works with a predetermined number of pages for a given year, whereas the editor of *MR* must publish reviews of all the literature to appear within the period for which his budget was prepared. Thus the editor of *MR* must literally live on a day-to-day basis with data concerning the publication of mathematical papers and books, the appearance of new journals, etc. The following table lists the number of papers reviewed each year from 1940, the

TABLE 1

Number of Papers Reviewed Annually by MR 1940–1965

Year	*No. of Reviews*	*Year*	*No. of Reviews*
1940	2,224	1953	7,269
1941	2,326	1954	6,850
1942	2,023	1955	7,522
1943	1,846	1956	7,977
1944	1,770	1957	6,207
1945	1,795	1958	7,889
1946	3,413	1959	7,609
1947	3,894	1960	7,824
1948	4,033	1961	13,382
1949	4,482	1962	13,743
1950	4,842	1963	13,297
1951	5,638	1964	12,570
1952	6,409	1965	12,907

year of inception of *MR*. In Figure 1 these data are shown in the form of a graph. From 1940 to 1956, the graph appears roughly as a

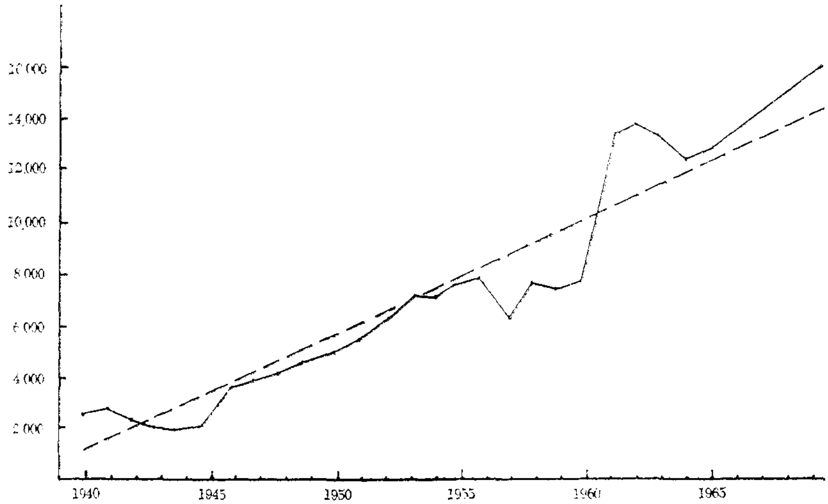

Figure 1. Growth in number of papers reviewed yearly by MR.

straight line, and from 1956 onwards the straight line has been continued as a dotted line; the heavy black line represents the actual number of reviews published. The sharp dip of the graph below the dotted line between 1956 and 1961 was caused by the accumulation of an enormous backlog of unreviewed papers in the editorial offices during those years; the clearing of this backlog is indicated by the sharp rise in 1961. The receipt of published material followed rather closely the straight line during this period, however. By 1963 reviews were appearing on a current basis, and the production level once again approximates the broken line extrapolation from 1956. There have been no recent startling increases in the literature situation in the past year or two which might cause a significant change in the pattern, and because the coverage of the world's literature is virtually complete, the conclusion to be drawn is that *the growth of published mathematical research is linear (and not exponential), with an annual increase of about five hundred items.* The coverage of *MR* has always included highly mathematical papers in such allied fields as theoretical mechanics, continuum mechanics (elasticity and fluid mechanics), quantum mechanics, statistical mechanics, astronomy and relativity, etc., and in the period from 1957 to 1961, this coverage was broadened extensively to include papers in these areas which could not be called theoretical by any standard. Even though there was a pruning of the less mathematical papers in these areas after 1961, the present coverage of applied fields is far more liberal than it was up through 1956, so that the number of reviews published, as indicated in the table and graph above, are to be considered higher than they would have been, had the criteria of coverage up to 1956 been applied to them. In other words, not only is the rate of growth of the mathematical literature far lower than is generally believed, the rate of growth of the literature of mathematics, theoretical physics and mechanics combined is lower than that popularly attributed to mathematics alone. One may ask whether any substantial increase may be anticipated because of an unusually large number of new Ph.D.'s. The following figures are taken from the annual *Earned Degrees Conferred* reports of the U.S. Office of Education.[3]

TABLE 2

Ph.D.'s Granted in Mathematics 1949–1965

Year	*Ph.D.'s (Math.)*
1949–50	160
1954–55	250
1959–60	303
1960–61	344
1961–62	396
1964–65	483

The rate of production of new Ph.D.'s is relatively low, indicating that no startling effects on the estimate of the growth of the mathematical literature may be expected in the near future from this source. (It is shown below that the same criteria have been used to estimate the growth of the world's chemical literature. One must be careful not to extrapolate these figures to scientific publication as a whole, for mathematical publication is too small a fraction of the total, and, far more important, mathematical research and its publication are not typical of research and publication in most scientific fields, although the mathematician's information problems are not unique from the librarian's point of view.)

In the symposium on publication of mathematical literature cited above,[4] reference is made to the number of journals in which the mathematical literature is to be found. In each index issue, *MR* publishes a list of journals from which it selected its literature; the following table shows the number of journals carrying mathematical articles.

TABLE 3

Numbers of Journals Carrying Mathematical Articles 1948–1965

Year	*No. of Journals*	*Year*	*No. of Journals*
1948	794	1960	1060
1950	868	1961	946
1952	793	1962	954
1954	796	1963	878
1956	975	1964	881
1958	961	1965	887

It is very easy to misinterpret these figures, for there is no distinction between a monthly mathematical journal carrying thirty mathematical papers and the proceedings of a scientific academy carrying one mathematical paper each year. No significance is to be attached to the decrease in the number of journals in the early 1960's; a systematic effort was undertaken during that period to determine whether a number of journals had officially ceased publication or ceased carrying mathematical articles.

Other Reviewing and Abstracting Services. MR began in 1940, and was patterned after the *Zentralblatt für Mathematik (Zbl)* (Berlin 1931–). For various reasons, including the fact that it is published privately, the *Zentralblatt* has never recovered from the effects of the war; the time lag between the appearance of an article and its review is all too frequently between four and six years, and the coverage of the mathematical literature is selective rather than comprehensive.

In 1953 there appeared the Soviet reviewing journal, *Referativnyi Zhurnal. Matematika (RZMat),* which is almost identical in format, style, and purpose to *MR,* except that all reviews are written in Russian. The reviewing staff comprises almost the entire professional community of the USSR, together with a relatively small number of Eastern Europeans. The coverage is about the same as that of *MR,* except that a large number of pedagogical articles are listed in *RZMat;* books are usually listed in *RZMat* but reviewed elsewhere, e.g., *Novye Knigi za Rubezhom.* During the editorship of J. V. Wehausen (1950–56), *MR* established extensive reciprocity arrangements with both *Zbl* and *RZMat*, by which *MR* may reprint reviews appearing in *Zbl* or *RZMat*, and vice versa, in order to prevent excessive delay in the appearance of the review of a paper; since all three journals reflect almost identically the needs of the working mathematician, such exchanges are mutually advantageous. In no sense can the three services be thought of as competitive, for independent reviews of the same article give perspective to the research involved; indeed, it is with regret that *MR* and *RZMat* watched the decline of *Zbl*.

Since the founding of *MR* in 1940, new abstracting or reviewing journals have been established in certain peripheral areas of coverage of *MR*, e.g., in computing and operational research. These abstracting journals were encouraged by *MR* in the sense that lists of potential reviewers were made available to them, as well as information concerning the existence and availability of scientific materials in their areas, and reciprocity arrangements were made with them for the use of completed reviews from *MR*. The major abstracting services with which *MR* has reciprocity arrangements of some sort are *RZMat, Zbl, Applied Mechanics Reviews* (New York, 1948–), *Computing Reviews* (New York, 1960–), *Mathematics of Computation* (Washington, D.C., 1943–), *Operations Research* (Baltimore, 1952–), and *Science Abstracts* (New York, 1902–).

Soviet Literature. Because both *MR* and *RZMat* seek to provide as exhaustive coverage as possible of the world's mathematical literature, these journals are the best source of discovering what has been done by the Soviet mathematicians. An extremely important guide to the Soviet literature published since 1917 is the two-volume Russian work, *Mathematics in the USSR for the Forty-Year Period 1917–1957 (Matematika v SSSR za Sorok Let 1917–1957)*, (Fizmatgiz, Moscow, 1959), which may be described as follows. The first volume consists of an extensive collection (985 pages) of comprehensive survey articles dealing with Soviet contributions to modern mathematics; these survey articles were written by forty-five leading research mathematicians, and, despite the fact that references are made to the Western literature in order to describe the genesis and importance of certain problems, the emphasis is overwhelmingly on the Soviet character of the work. Significant as the first volume may be, the importance of the second volume cannot be overemphasized, for it contains a bibliography of almost every mathematical paper published by every Soviet mathematician since 1917; the bibliography lists about 22,000 articles and books by more than 3,600 authors. This two-volume work is far more comprehensive and accurate than its predecessor, *Mathematics in the USSR for the Thirty-Year Period 1917–1947 (Matematika v SSSR za Tridtsat' Let 1917–1947),* (GITTL, Moscow, 1948), which lists only the more important works of the authors cited; moreover, the 1917-1957 bibliographical work provides, for the first time, biographical data and addresses (as of January, 1958) of the Soviet mathematicians listed. It should be remarked that the first volume of this nature appeared in 1932 *(Mathematics in the USSR for the Fifteen-Year Period 1917–1932),* and that similar projects have been undertaken in other areas related to mathematics, e.g., mechanics.

More recently, possibly in preparation for the fiftieth anniversary of the 1917 Revolution, an extensive series of detailed survey articles has begun to appear under the new series title *Itogi Nauki.* The nature of the surveys is similar to that in the volumes mentioned above except that the contents are based on reviews appearing in *RZMat;* consequently, the material is of a more recent character, and, of more scientific importance, the perspective is universal in nature rather than Soviet. The bibliographies for some of these survey articles contain as many as eight hundred entries, and are not limited to Soviet entries. Several volumes have already appeared and one recent issue of *Novye Knigi v SSSR* (1965, no. 52) lists forty-seven volumes to be published in 1966.

Other Reference Tools. The number of other reference materials which are of prime importance, both to the working mathematician and to the mathematics librarian, is too extensive to be detailed here. Instead, the reader is referred to a valuable little guidebook by John E. Pemberton, *How to find out in Mathematics* (Macmillan, New York, 1963), which contains a substantial core of information which ought to be at the fingertips of any mathematician seeking information from the library. This section will therefore be restricted to adding certain recent items to Pemberton's guidebook and to commenting on the reliability of some of the items which are described there.

One of the most valuable references to the research mathematician is a dictionary of the terminology in current use, for mathematics—and to a lesser extent, theoretical physics—has become so specialized that the terminology in one area of mathematics is today virtually incomprehensible to a worker in another area. The need for such a reference work is quite apparent when one realizes that the most exciting and fruitful advances generally occur on the borderline of two disciplines. In general, the greatest obstacle to be overcome as one moves across the borderline into the new discipline is the new terminology and the possible lack of authoritative surveys of the new territory. The only English dictionary of the sort described above has been that of Glenn James and Robert C. James, *Mathematics Dictionary* (Princeton, N.J., Van Nostrand, 1959), but the terminology of James and James is more appropriate for today's undergraduate mathematics than for the needs of a professional mathematician. A far more comprehensive work is the two-volume *Mathematisches Wörterbuch* (B. G. Teubner, Stuttgart, 1961) edited by J. Naas and H. L. Schmid. The fact that it is in German will not handicap the professional mathematician; what is more serious is the fact that it has recently gone out of print, and it is hoped that a new printing will appear soon. The *Mathematisches Wörterbuch* has the drawback that it is not as universally comprehensive as one might wish; this may be due to the fact that there are several major disciplines of mathematics today in which the Germans are not active, so that the lack of compilers in these areas is understandable. The most comprehensive reference work of this sort (and the most inexpensive) is the *Iwanami Mathematical Dictionary* (edited by the Mathematical Society of Japan; rev. ed., Iwanami Shoten, Tokyo, 1960), which defines virtually every term used in mathematics today and gives references for further reading. The principal difficulty, however, is that it is in Japanese, although a complete multi-language index permits the user to find the entries in the Japanese text, so that the up-to-date references to a given topic may easily be found; for more detailed descriptions, see K. Nomizu's review of the *Iwanami Mathematical Dictionary* in *MR* (Vol. 24, # A644) and the author's review of the *Mathematisches Wörterbuch* in *MR* (Vol. 29, # 4658). A third edition of the *Iwanami Mathematical Dictionary* is now being completed (the second edition was reprinted in 1962), and the contributors have been asked to submit their copy in both Japanese and English, so that the prospects of an appearance of an English version of this superb reference work appear to be good. (One must not overlook the fact that the *Encyclopaedia Britannica* has extensive and authoritative review articles in certain areas.)

There are specialized dictionaries of this sort for a few of the mathematical disciplines; two of the most outstanding are Maurice G. Kendall and William R. Buckland's *Dictionary of Statistical Terms* (2d ed., Oliver and Boyd, Edinburgh, 1960) and Donald H. Menzel's *Fundamental Formulas of Physics* (Prentice-Hall, New York, 1955), although the latter has rapidly become out of date and needs revision.

For the mathematician reading papers in his specialty in another language, the needs change; he does not require a dictionary describing the mathematical concepts involved, but rather a dictionary which tells him that a certain foreign word or phrase is equivalent to an English word or phrase whose English meaning he already knows. The professional mathematician usually has a working knowledge of German and French, at least in his specialty, and no sympathy should be given to the professional who cannot handle these languages. For the student who is seeking professional status, however, there is no really comprehensive up-to-date German-English or French-English dictionary of mathematical terminology; because of its detailed cross-indexing, the *Iwanami Mathematical Dictionary* can frequently be used in the capacity of a multilingual dictionary.

Since the amount of mathematical literature appearing in Russian is between one-fourth and one-third of the total publication, and because some of the Soviet mathematicians are making superb contributions, the need for a third language has imposed itself on the professionals, many of whom have solved the problem simply by learning to read Russian. Many Russian journals are now available in cover-to-cover translation; for a list of Russian journals in translation see any recent index issue of *MR*. (It is amusing to note that, if all Russian literature were available in translation so that American mathematicians had no need to learn Russian, then there would eventually be no one to translate the Russian journals. In one sense, it is fortunate that the quality of most of these translations is low enough so that the professional feels that he ought to learn sufficient Russian to read these papers in the original when the need arises.) Adequate Russian-English reference material is now available, and it suffices to add to Pemberton's references the comprehensive *English-Russian Dictionary of Mathematical Terms* (Moscow, Izdatel'stvo Inostrannoĭ Literatury, 1962), which was compiled as a companion volume, in a joint project of the National Academy of Sciences and the Soviet Academy of Sciences, to A. J. Lohwater's *Russian-English Dictionary of the Mathematical Sciences* (Providence, R.I., American Mathematical Society, 1961); Samuel Kotz's *Russian-English Dictionary of Statistical Terms and Expressions* (Chapel Hill, University of North Carolina Press, 1964) is also a useful addition to Pemberton's list of Russian-English dictionaries.

Mathematical literature of some importance appears in other languages, most frequently in Polish, Ukrainian, Serbo-Croatian and

Chinese; however, the need for bilingual dictionaries for these languages has not been critical, but relatively useful mathematical glossaries have been produced in the Soviet Union with Russian, rather than English, as the basic language. The best of these are the *Słownik Matematyczny Polsko-Rosyjski* of Mikłaszewska and Mikłaszewski (Fizmatgiz, Moscow, 1963), and the *Rosiĭs'ko-Ukraïns'kiĭ Matematichniĭ Slovnik* (Vidavnitstvo Akad. Nauk Ukr. RSR, Kiev, 1960). A multilingual glossary published in 1961 by Państwowe Wydawnictwo Naukowe, *Słownik Terminów Fizycznych,* has a useful but not comprehensive coverage in the peripheral areas of mathematics; it has glossaries in Polish, English, French, German, and Russian. The amount of mathematical research from China is relatively small and generally of low quality at the present; most papers in Chinese appear in *Acta Mathematica Sinica* with translations into English or Russian of the better papers appearing simultaneously in *Scientia Sinica* (Peking, Academia Sinica, 1952–). The American Mathematical Society translates the *Acta Mathematica Sinica* regularly (Providence, R.I., American Mathematical Society, 1962–); this experience should prove useful for the future when the need for translation of the Chinese literature becomes apparent.

"Unpublished" Literature. In addition to the regularly published literature there is in circulation another type, often referred to as preprints or technical reports. These preprints and reports are circulated as preliminary drafts for the comments of colleagues or as progress reports meeting the requirements of a research contract, and properly should be considered as part of a mathematician's personal correspondence. None of the mathematical reviewing journals considers such material to be published literature, and most authors of such reports or preprints prefer not to have this material reviewed; at the Symposium on Mathematical Literature mentioned above,[2] H. A. Wooster, Director, Information Sciences Directorate, Air Force Office of Scientific Research, explained why the normal distribution list for a technical report is usually limited to a hundred copies:

> This is done for two reasons. One, we sort of hope it won't influence journal acceptance . . . that the journal will look the other way and consider this as not constituting publication; and the other, far more practical, is that the joint Congressional Committee on Printing and Binding looks with great disfavor on your publishing much more than 100 copies. I can't imagine a journal subsisting on a mailing list

of 100 and I've seen very few technical reports with more than 200 on the distribution list.[4]

Conclusions. The data given above concerning the growth of the mathematical literature are based on the coverage of *MR;* that this method of estimating the growth of scientific literature is standard is shown by the following paragraph from Wallace R. Brode's article "The Growth of Science and a National Scientific Program" (*American Scientist,* 50:1-28, March 1962) accepted as testimony before a Senate Subcommittee.[5]

> One of the best measures of the quality and quantity of our scientific literature is the abstract journal. Outstanding as an abstract journal is *Chemical Abstracts,* published by the American Chemical Society, which endeavors to collect and abstract every available contribution in all languages from all parts of the world. The area of chemistry represents only about 20% of the technological literature, but chemistry is typical of science as a whole . . . . Thus the area of chemistry as a whole provides a good guide upon which to base our broad predictions. Perhaps as important is the fact that *Chemical Abstracts* is outstanding in its world coverage and hence provides the best international source for such predictions.

That the comprehensive coverage of *Chemical Abstracts* yields one of the best measures, if not the best measure, of the growth of the chemical literature is beyond dispute, and the growth of the literature in several of the scientific disciplines is undoubtedly comparable to that of chemistry, namely, the expansion rate is about 10 percent per year, or equivalently, a doubling of the annual world production every eight years. However, by applying the same criteria to mathematics, it is clear that mathematics may not be thought of as "typical of science as a whole." This dissimilarity is reflected in the difference between the reviews in *MR* and the abstracts or reviews in most other abstracting journals, where an author's summary or an abstract by a non-specialist can give a relatively objective description of the contents of the article. The contents of a mathematical paper cannot be abstracted in this way, even by the author; in fact, leaving aside the difference in emphasis which one would expect from different abstracters (including the author), there may still be essential differences in the abstracts of a paper straddling say, mathematics and electromagnetic theory, depending upon whether it is written from the standpoint of a mathematician, physicist or electrical engineer. Indeed, an adequate abstract from the standpoint of one of these groups might completely disguise the facts of most interest to the other. Obviously an abstract to the effect that a certain energy level has been measured must differ in form from a description of a learning experiment on rats, and neither report should resemble a mathematical review. Indeed, the need for the type of review provided by *MR* has been expressed by many theoretical physicists; the statement by Professor Armand Siegel [6] is typical of these needs:

> I think the method of abstracting by an original review, written by an experienced worker in the field, is one of the few significant advances in the methods of scientific publication during the modern era.
>
> The reviews published in *Mathematical Reviews* make vivid reading, and are far more useful than author's abstracts. An outsider who abstracts an article will have more of a sense of proportion about it than the author, and understand better what is important and what is unimportant to a reader who comes to it without previous acquaintance. Furthermore, the reviews stimulate the field, I think, by allowing a forum for opinions . . . on the merits of new developments.

Scientific literature, including the mathematical literature, has been growing, and the data indicate that the rate of growth in mathematics is much smaller than that in other disciplines, and certainly much smaller than is generally believed. In the absence of any figures, it is natural that there should have appeared on the scene an army of innovators with instant (and expensive) solutions; no comment will be made here [7] on the wide spectrum of motives, except to mention how far afield one can be carried by the ignorance of standard bibliographical methods and by obsession with innovation for the sake of innovation, and lack of information. The most striking example being cited by over-zealous proponents in the area of information retrieval as typical of the urgency of today's problems is a relatively trivial article of A. G. Lunts (*Doklady Akademiia Nauk SSSR*, 70:421-423, 1950), which was abstracted in *MR* (Vol. 11, p. 574) and given proper subject indexing and cross-indexing in the appropriate sections of the monthly issue. A small part of this story is described in a paper by A. G. Oettinger,[8] whose summary sets the stage:

> A frequently quoted and still current myth on the ill effects of the so-called information explosion is analyzed. Five years and 250,000 dollars were allegedly spent in the United States to duplicate the re-

> sult published in the Soviet Union in 1950. Not only does this myth rest on a comedy of errors, but the trivial results in question were surprisingly well known to all specialists most concerned, in at least one instance as early as 1937.

This myth was even carried to the floor of the U.S. Congress recently by the Hon. Roman C. Pucinski, who asserted that a "team of top-notch mathematicians" worked for five years to obtain an independent solution of the problem. It had been predicted in 1957 by R. P. Boas [9] that this particular example would achieve the status of a *cause célèbre*. One may ask whether it might have been cheaper to instruct this "team of top-notch mathematicians" in the simplest research techniques, that is, intelligent use of journals and reference tools, than to deluge them with the amount of print-out material that has so frequently been proposed. One cannot but agree with Boas that no quick or easy substitute for competent scholarship is yet in sight.

The library, in the future as in the past, will continue to serve the mathematician as the laboratory serves the experimentalist. Information concerning the permanently recorded literature will be provided efficiently, as in the past, by the reviewing journals *MR* and *RZMat*. New disciplines in mathematics arise regularly, forcing both major and minor revisions in the subject classifications of mathematics, and these give way to newer disciplines, so that no subject classification may be treated as permanent. The editors of *MR* and *RZMat* are in closer contact than anyone else with the trends and nuances of subject classification, and these changing trends are manifested in the classification schemes published in the monthly issues and index issues of *MR* and *RZMat*.

Based on the comprehensive coverage in *MR*, some thought has been directed recently to the possibilities of extensive survey articles on recent developments in certain branches of mathematics; in this respect there is considerable lag behind the Soviet Union. A minimal, although extremely valuable, survey of any discipline undergoing rapid development (e.g., ordinary differential equations or quantum field theory) could be provided if one of the international mathematical societies sponsoring *MR* were to assemble the reviews of the literature in the particular discipline and reproduce them inexpensively by a photo-offset process.

Other services might be suggested if the full potential of *MR* were to be tapped. It must be mentioned in closing that the international character of *MR* cannot be overemphasized; the American mathematical community is not large enough to review or abstract the world's mathematical literature. Because the participation and involvement of European and Japanese mathematicians is as deep as the American, and because the bibliographical and reviewing services of *MR* meet their needs as fully as the American needs, it is difficult to envision radical changes from the present form, except by some unilateral action based upon an obsession for innovation for the sake of innovation, which would ignore the fact that the present status of *MR* is the result of a concerted voluntary effort on the part of the world's professional mathematicians to create a bibliographical reference work to satisfy their professional mathematical needs.

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2. Block, I. E., and Drenick, R. F., eds. "A Symposium on the Publication of Mathematical Literature," *SIAM Review,* 6:431, Oct. 1964.

3. For a more detailed analysis of data in mathematics and other fields, *see: Conference on Manpower Problems in the Training of Mathematicians: Report.* Washington, D.C., Conference Board of the Mathematical Sciences, 1963.

4. Block and Drenick, *op. cit.*, p. 454.

5. U.S. Congress. Hearing before the Senate Committee on Government Operations. "Create a Commission on Science and Technology" (S. 2771). 87th Cong., 2d Sess., May 10, 1962, Part 1, pp. 69-70.

6. *Notices of the American Mathematical Society,* 11:40-41, Jan. 1964.

7. One of the most significant pieces of literature to have appeared in the area of information retrieval is a collection of essays of Y. Bar-Hillel, *Language and Information: Selected Essays on their Theory and Application,* Reading, Mass., Addison-Wesley, 1964.

8. Oettinger, A. G. "An essay on information retrieval or the birth of a myth," *Information and Control,* 8:64-79, 1965; reviewed in *MR,* Vol. 29, # 6960.

9. Boas, R. P. Letter to the editor, *Science,* 125:1260, June 21, 1957. Professor Boas was Executive Editor of *Mathematical Reviews* from 1945 to 1950; his observations apparently did not cause sufficient loss of money to warrant comment on the floor of the U.S. Congress. *Received May 1, 1966.*