

# A Brief History of the Mathematical Literature

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**Summary:** The purpose of this article is to review the development of the mathematical literature by briefly tracing the history of mathematical communication leading to the founding of Mathematical Reviews in 1940. We touch on the formation of the academies and the mathematical societies, and mention some of the early journals published by these groups. Finally, we discuss the emergence of the mathematical reviewing journals. We do not discuss the growth of privately circulated unpublished literature, conference proceedings or the recent development of electronic forms of communication in mathematics.

In the beginning, communication in mathematics presumably was mainly by word of mouth between scholar and student, and between individual scholars. Later came the schools of mathematics and the “academies”, such as Plato’s academy in ancient Athens, or the school of Euclid in Alexandria. Scholars there communicated orally and also by letters and manuscripts. But, since all of these early manuscripts were hand-copied, they were few in number. While many of these manuscripts have been handed down through the years, one can only wonder how much early mathematics has been lost without a trace. The invention of the printing press provided a revolution in communication and facilitated enormously the spread of ideas through the printed book. According to Eves [E;p.517], the first printed arithmetic book was published in Treviso, Italy, in 1478, the first edition of Euclid’s *Elements* appeared in 1482, and the first work on mathematics printed in the New World appeared in 1556.

**The academies.** The great increase in scientific and mathematical activity that began to flourish in the sixteenth century led to the formation of groups of persons who met, sometimes regularly, for discussion and an exchange of ideas. Some of these groups later crystallized into what became academies, the first of which seems to have been established in Naples around 1560 [E;p.390] [St;p.101]. The Accademia dei Lincei (Academy of the Lynx-like) was founded in 1603 and Galileo became a member in 1611. According to Kline [K;p.396], in France, Desargues, Descartes, Fermat, and Pascal, among others, met privately under the leadership of Mersenne from 1630, and corresponded widely (see also [St;p.100 ff.]). This informal group led to the chartering of the Académie Royale des Sciences in 1616 by Louis XIV (and the Académie des Sciences in 1666). Similarly, an English group led by John Wallis began to hold meetings in 1645 in Gresham College, London. This group was given a charter by Charles II in 1662 and adopted the name of the Royal Society of London for the Promotion of Natural Knowledge; Wallis was a charter member. The Berlin Academy of Sciences was founded in 1700 with Leibniz as its first president. In Russia, Peter the Great founded the Academy of Sciences in St. Petersburg in 1724.

These academies were very important for the development of science and, in particular, of mathematics; indeed, many of the most important mathematicians of the eighteenth century were supported by these academies and never had a university position. The academies promoted the

exchange of ideas both by facilitating the direct contact of the leading scientists and also by the publications that the academies soon started. While there were various reasons for the support of the academies by the rulers, it is clear that one reason was that the monarchs saw the importance of the emerging science and technology for the civil and military needs of their realms, and realized that mathematics was essential for this scientific development.

It may come as a surprise to the modern scientist to realize that the universities of the time played little role in the scientific development that was taking place. Instead, with a few isolated exceptions, the universities, still under the dead hand of the church, remained conservative centers of scholasticism and often taught only a meager amount of mathematics. It was not until the end of the eighteenth century that the universities began to become centers of research [K;pp.397–398][St;p.101].

**The scientific journals.** Despite what has just been said about the academies being the centers of research, the first scientific journals were organized privately. It is agreed that the first scientific periodical was the *Journal des Sçavans* (later called the *Journal des Savants*), which was first published on 5 January 1665 by D. de Sallo, a counsellor of the French court (see [G;p.115], [Sc;p.49]). It appears to have been more of a magazine reporting on scientific developments directed to the educated and curious than what we think of as a scientific journal publishing research articles. Only two months later, there appeared the *Philosophical Transactions*, launched by Henry Oldenburg, the secretary of the Royal Society of London—but it was not until 1753 that this journal became an official publication of the Royal Society. One of the most notable periodicals of its time was the *Acta Eruditorum*, published monthly at Leipzig from 1682; it was edited by O. Mencke until 1707, but Leibniz was also influential in its founding and was a frequent contributor to it. In fact Leibniz published his first paper on the differential calculus there in 1684, and his paper containing the rudiments of the integral calculus there in 1686, although he had developed this work between 1673 and 1676 [St;p.111]. (Newton's *Principia* was published in 1687.)

A number of elementary mathematics magazines were started in the early part of the eighteenth century. Some contained mathematical problems and puzzles and were aimed more at entertaining their readers than advancing mathematical knowledge. Notable among these was the English publication *The Ladies' Diary*, published from 1704–1840. G. A. Miller [M;pp.38–39] quotes two problems and their solutions that were given in rhyme in early issues of this publication; he asserts that in later numbers more important mathematical questions appeared. He also asserts that the *Gentleman's Diary or the Mathematical Repository*, published 1741–1840, may be regarded as a scientific mathematical journal and contains a number of important problems and solutions relating to elementary mathematics.

Although journals published by the academies were not the first to be founded, they became among the most important and influential. The earliest academy journal appears to have been the *Miscellanea Curiosa Medico-Physica*, begun in Leipzig in 1670 by a society that (in 1682) became the Academia Caesareo-Leopoldina Naturae Curiosorum. Of enormous influence was the *Histoire et Mémoires* of the Académie Royale des Sciences in Paris, which started publication in

1699. The next few years saw the foundation of a number of academy journals in Berlin, Uppsala, St. Petersburg, Bologna, Stockholm, etc. Until 1770 it was the periodicals of the academies that provided the main vehicle of communication among researchers [G;p.115 ff.]. But these journals were general in nature, with only an occasional article devoted to mathematical topics.

Beginning about 1770 more specialized journals began to appear in various sciences, but mathematics was not one of the first areas to have specialized journals. In 1794 the *Journal Polytechnique* (soon renamed the *Journal de l'Ecole Polytechnique*) was founded at the famous French school; in effect it was primarily a mathematical journal. The first journal devoted exclusively to mathematics was the French journal *Annales de Mathématiques Pures et Appliquées*, founded and edited by J. D. Gergonne and published from 1810 to 1831. The next was *Correspondance Mathématique et Physique*, edited by J. G. Garnier and A. Quetelet in Gand/Bruxelles, 1825–1839. The oldest mathematics journal still in existence is the famous *Journal für die Reine und Angewandte Mathematik*, founded in Germany by A. L. Crelle in 1826 and edited by him until his death in 1855. The first British mathematical journal was *The Cambridge Mathematical Journal*, founded in 1839 by D. F. Gregory and R. L. Ellis; a continuation of this journal was later to become *The Quarterly Journal of Pure and Applied Mathematics*, which was edited for a time by J. J. Sylvester and others.

**Mathematical societies.** It is difficult to say where and when the first (modern style) mathematical society was founded, but the oldest one still in existence is the Mathematische Gesellschaft in Hamburg. It was founded in 1690 (and so is celebrating its tercentenary this year!) as the *Kunstrechnungsliebende Societät*, and has long published a journal. Another early one is the *Spielfields Mathematical Society*, which lasted from 1717 to 1846, initially meeting in a pub in east London; it was ultimately absorbed into the Royal Astronomical Society in 1846. (See also [M;p.44 fn.] and especially [Cs] for an entertaining account, where it is indicated that there were at least three other “mathematical societies” in London during the early eighteenth century.)

The day of the amateurs passed, and the professionals began to take over with the formation of the national mathematical societies. The first such society is the *Wiskundig Genootschap*, founded in Amsterdam in 1778, but most national societies were founded considerably later: the *Moscow Mathematical Society* in 1864, the *London Mathematical Society* in 1865, the *Société Mathématique de France* in 1872, the *Mathematical Society of Japan* in 1877, the *Edinburgh Mathematical Society* in 1883, the *Circolo Matematico di Palermo* in 1884, the *New York Mathematical Society* (later the *American Mathematical Society*) in 1888 and the *Deutsche Mathematiker-Vereinigung* in 1890. Most of these societies commenced the publication of a mathematical journal soon after their foundation and many of these journals have played, and still play, an important role in mathematical communication.

According to Müller [Mü], before 1700 there were only 17 journals publishing articles with mathematical content, during the eighteenth century there were 210 new journals with mathematical articles, and during the nineteenth century there were another 950 new journals. (In this reckoning a continuation of a journal under a different title is considered as a “new” journal.) However,

before 1900 about half of these journals had ceased publication or changed titles, so that in 1900 there were about 600 existing journals containing some mathematical articles!

**The secondary journals.** By the middle of the nineteenth century, mathematics had become specialized to the extent and the number of journals so large that it was not only impossible for one person to master it in its entirety, but even difficult for one to keep fully apprised of the developments in his or her area. It was clear that there was a need for a more systematic method of communication between mathematical researchers, so the bibliographic (or “secondary”) journal was born.

Wölffing [W] gives an account of the various bibliographic journals founded before 1903; see also [M;pp. 275–282] for an annotated list of mathematical bibliographies and encyclopedias published before 1916. Certainly the most important secondary journal in mathematics was the *Jahrbuch über die Fortschritte der Mathematik*, founded in 1868 under the direction of Carl Ohrtmann and Felix Müller (and soon joined by Albert Wangerin) in Berlin. Among others we mention the bibliographic journal *Bulletin des Sciences Mathématiques et Astronomiques*, founded in Paris in 1870 and edited by G. Darboux; it consisted mainly of a list of publications. The journal *Revue Semestrielle des Publications Mathématiques* was founded in Amsterdam in 1893 and gave short summaries but no critical reviews.

**The *Jahrbuch* and *Zentralblatt*.** The format of the *Jahrbuch* was to collect reviews of all the mathematical articles published in a given year in one volume. The first volume, published in 1871, contained reviews of articles published in 1868; it contained 426 pages and there were 16 reviewers, all German and most from Berlin. The second volume, published in 1873, covering the two years 1869 and 1870, consisted of 902 pages. The third volume, published in 1874 and covering 1871, contained 588 pages and listed 33 reviewers (including Cayley and Lie and some other non-German reviewers). Volume 31, published in 1902 and covering the year 1900, contained 970 pages and listed 59 reviewers. World War I caused considerable interference with the publication schedule of the journal, and, while efforts were made to catch up, Volume 50, covering 1924, did not appear until 1929; it contained 749 pages and listed 153 reviewers.

In the first volume of *Jahrbuch*, the mathematical universe was broken into the following twelve sections; History and philosophy, Algebra, Number theory, Probability, Series, Differential and integral calculus, Function theory, Analytic geometry, Synthetic geometry, Mechanics, Mathematical physics, and Geodesy and astronomy. One might be struck by the overall similarity with the present-day classification system used by Mathematical Reviews. There are a substantial number of “title reviews”, that is, mere listing of the item without further comment, but many of the items have a critical review.

The original hope that the *Jahrbuch* might appear soon after the year being covered proved to be an illusion. Journals were slow to be published or to be received by the *Jahrbuch* office, reviewers were slow, there were difficulties with the printers, etc. In any case, by the late 1920s there was widespread dissatisfaction with the *Jahrbuch*, due largely to this time lag. Otto Neugebauer, then

a young professor at Göttingen, conceived the idea of a journal that would publish the reviews of articles as soon as possible after the papers had appeared and persuaded the publishing house of J. Springer to publish such a journal. The first issue of *Zentralblatt für Mathematik und ihre Grenzgebiete*, as the new journal was called, dated April 14, 1931, had Neugebauer as its editor. It also had a very distinguished and international editorial committee (consisting of P. Alexandroff, J. Bartels, W. Blaschke, R. Courant, H. Hahn, G. H. Hardy, F. Hund, G. Julia, O. Kellogg, H. Kienle, T. Levi-Civita, R. Nevanlinna, H. Thirring and B. L. van der Waerden). The first volume consisted of seven issues plus an index, in 466 pages. (The very first item reviewed was the second edition of *Methoden der mathematischen Physik*, by Courant and Hilbert.) The classification system used was very similar to the scheme used by *Jahrbuch*.

**Mathematical Reviews.** *Zentralblatt* flourished under Neugebauer's direction and became the primary reviewing journal in mathematics. *Jahrbuch* valiantly continued until issue number 4 of its Volume 68, for the year 1942, ceasing publication in mid-1944, but it had already lost its prominence in the research community. But, just as World War I damaged *Jahrbuch*, serious harm was done to *Zentralblatt* soon after its founding by political conditions beyond its control. The anti-Semitic and anti-Soviet policies of the Nazi regime generated pressures on the editorial policies of *Zentralblatt* concerning the use of Jewish and Russian reviewers. Although Neugebauer left Göttingen for the University of Copenhagen in 1934, he had continued to edit *Zentralblatt*. But by 1938 the intrusion of politics had become intolerable and he and other members of the editorial board resigned. Despite these difficulties *Zentralblatt* continued its operation and, except for a brief suspension of publication from November 1944 until June 1948, has continued to publish to the present day.

There were other problems in 1938: the oncoming war was making publication and international cooperation difficult, particularly when the site of publication of *Zentralblatt* was Berlin. In addition, the influx of many refugee research mathematicians to the United States (which had already begun to become a power in mathematical research) helped shift the center of gravity in mathematics from central Europe. The story of the founding of Mathematical Reviews is an interesting one, but it is well presented in a chapter of the book *A history of the second fifty years* by Everett Pitcher [P]; consequently, the details of this story will not be repeated here. (See also the article by Reingold [R].) We summarize this history by mentioning that subventions were obtained from the Carnegie Corporation, the Rockefeller Foundation, and the American Philosophical Society to start a reviewing journal, to be called Mathematical Reviews, with an initial annual budget of \$20,000. The Executive Committee consisted of Oswald Veblen, chairman, T. C. Fry, and Warren Weaver; their names did not appear on the cover of the new journal, and neither did the names of the co-editors, Otto Neugebauer and J. D. Tamarkin (both of whom were professors at Brown University by that time), or their technical assistant, Willy Feller. The coverage of the new journal was to start as of mid-1939, and its extent was to be the same as that of *Zentralblatt*. There has been very little basic change in the coverage of MR to the present day.

It is difficult to imagine the frenzy of activity that must have ensued in the second half of the

year 1939. There were journals and books to acquire, reviewers to be recruited, subscriptions to be sold, a printer to be retained, etc. Pitcher writes [op. cit.] that, before the first issue of MR appeared, there were about 700 subscribers and 350 reviewers, with about 220 from the United States and Canada. The first issue of MR, dated January 1940, contained 176 reviews in 36 pages; the first volume contained exactly 400 pages, with 2120 reviews, written by 287 reviewers. While a number of these reviews were editorial reviews or title listings, it is clear that the panel of early reviewers were a hard-worked crew.

They were also a very distinguished crew (see pp. 9–11 for a listing of the individuals who wrote reviews that were published in Volume 1 of MR)—almost every leading mathematician in the U.S. of that time is on this list. While the majority of these mathematicians were resident in the U.S. or Canada, there were a number from other countries (the U.K., the Netherlands, Switzerland, France, Japan, U.S.S.R., etc.). When one recalls the unrest and turmoil then taking place in the world, it is even more remarkable that such a project could have been started at that time and succeeded. We owe a great debt of gratitude to these persons, particularly to Otto Neugebauer, who possessed the imagination and the energy to assume this task at such a difficult time in the world's history. It is vastly to his credit that he was able to enlist a remarkable panel of reviewers and obtain the cooperation of many persons to work on this endeavor.

For the past 50 years the editors of MR have been assisted by many persons throughout the world who regard the publication of this journal as worth their support. It is with considerable appreciation that the editors acknowledge their debt to them.

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