State of AMS 2004

The American Mathematical Society has different faces to different groups of mathematicians. Many young mathematicians focus on the Society's employment services and surveys, which help them to make career decisions. More established mathematicians sometimes associate the AMS with meetings, where they not only do mathematics but connect with friends and acquaintances as well. Mathematicians abroad often identify with the *Notices*, which keeps them informed about mathematics and the profession.

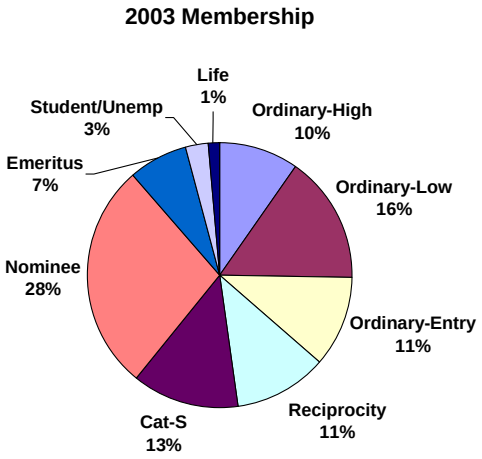
But for *many* mathematicians—especially those most actively engaged in research—the most apparent face of the Society is *MathSciNet*, the entryway to the Mathematical Reviews Database. Math Reviews has always been important to mathematicians, but *MathSciNet* has changed the way in which people do research (and many other things as well). It is an enormously successful part of the AMS publication program, and this year's annual report focuses on Mathematical Reviews and its great success.

First, here is an overview of the Society early in 2004.

Overview

The Society's membership grew to over 28,000 in 2003; during the current year, we expect membership to exceed 29,000. Most of that growth is in nominee members (graduate students who become members because their universities are institutional members). Ordinary membership has been slightly declining, as has reciprocity and Category-S (in the developing world). Life and emeritus memberships are up, reflecting our aging population.

The Society will carry out planning in specific areas each year for the next several years. The first of these focused planning efforts took place in 2003, and as a result the AMS will consider making various changes in membership—the principles by which we set dues, our delivery of member benefits, new categories of membership, etc. Most importantly, the planning process has helped us to understand some of the major issues surrounding membership. Membership development is now a separate function in the Society, viewed as an important ongoing activity.



Our meetings continue to be healthy and robust. The recent Joint Meeting in Phoenix was the fourth largest ever held by the

Society, and the program was widely praised by those attending. The sectional meetings continue to be one of the key ways in which the Society reaches mathematicians throughout the country. The Society held a joint international meeting in Bangalore, India, during December, and attendance exceeded 500 mathematicians (from the U.S., Europe, and India). The summer research conferences, which are now held at Snowbird in Utah, seem to be vigorous and healthy with a resurgence of proposals for future conferences.

The Washington Office of the Society has represented the interests of the mathematical community in Washington for more than ten years now. This is increasingly difficult in the present budgetary environment, but we have been successful nonetheless. The key to success in Washington is making sure that mathematics has a presence—that policy makers think of mathematics when they think about science and technology. We've accomplished this through such things as congressional luncheons, public service awards, and special receptions. But it's the day to day activities that ultimately build connections with all parts of Washington. The Washington Office also oversees special projects, including such things as the Media Fellows Program, the Chairs workshops, and mentoring workshops done jointly with the Mathematicians and Education Reform network (MER).

Many of the programs and services of the Society are ongoing, and for that reason it's easy to overlook their quality and value to the community; new and elaborate projects are easier to tout, even when they are short-lived. But providing sure and steady service to the community has been a hallmark of the Society. For example:

- We continue to conduct the annual Survey[1], which provides essential information about the profession.
- We plan and run the Employment Center[2] at the Joint Meeting.
- We administer the MathJobs service, which connects job applicants and participating departments.
- We publish various professional publications for the mathematics community, including *Employment Information in the Mathematical Sciences*[3], *Assistantships and Fellowships*[4], the *Professional Directory,* and the *Combined Membership List*[5].
- We provide annual Epsilon awards to encourage young scholars programs (summer programs for talented high school students) totaling approximately $80,000.

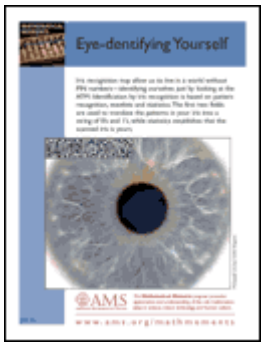
[1] Under the auspices of the AMS-ASA-IMS-MAA Data Committee
[2] With the advice of the AMS-MAA-SIAM Joint Committee on Employment Opportunities (JCEO)
[3] With the advice of JECO
[4] Compiled under the direction of the AMS-ASA-IMS-MAA Data Committee
[5] A joint project of the AMS, MAA, and SIAM

- We sponsor an Arnold Ross Lecture each year, aimed at high school students and normally held at a science museum.
- We hold 4-5 "Who Wants to be a Mathematician" games each year, attracting the best mathematics students in some area to participate in mathematics.
- We award annual Trjitzinsky scholarships of $4000 each to 8 mathematics undergraduates.
- We award Centennial Fellowships each year to young mathematicians in the early stages of their careers, allowing them to spend a year fully engaged in research.
- We award annual Ky Fan travel grants to promote the exchange of mathematicians between North America and China.
- We conduct the Math in Moscow program, providing funds for approximately 10 students each year to study for a semester at the Independent University in Moscow, in a demanding mathematics program that builds future connections between our communities.

It is important to note that, with the exception of the last item, every one of these programs is ongoing and does not rely on grant support of any kind.

One of our *greatest* services to the mathematics community is the publication of our member journals, the *Notices* and the *Bulletin*. While only members receive these journals in paper form, the electronic versions are available to all mathematicians with access to the Internet. They are widely accessed throughout the world.

Public awareness is a special kind of service, and it has accomplished a great deal in the few years since the creation of our Public Awareness Office. We are building contacts with the press—a slow process that requires patient diligence to accomplish. *Mathematical Moments* (one page fliers with the simple message that mathematical research is important) have been extremely popular, especially among high school teachers who post them on classroom walls. The "Who Wants to be a Mathematician" contests mentioned above have drawn enthusiastic crowds of shouting students (which isn't something mathematics does very often). And the office has helped to highlight the Society itself, both inside and outside the mathematics community.



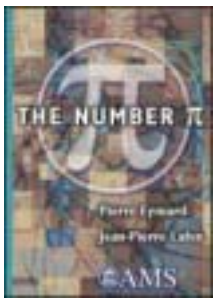
Of course, we could accomplish few of these services if the Society did not have a source of funding, and mainly that source is our publications program. We derive about 75% of our revenues from publications. (Members are almost always surprised to discover that individual dues account for only a small percentage of revenues—6.2% in 2003.) The health of our publications are therefore directly connected to the health of the Society overall.

Our research journals continue to do extremely well in almost every respect. Submissions to the journals are robust; backlogs are under control; and mathematicians view the journals with respect. While citation indices should be viewed cautiously in mathematics, it's interesting to note that the *Journal of the American Mathematical Society* now ranks first as measured by the ISI impact factor. Like most journals, ours experience slight attrition in subscriptions each year, but the attrition remains slight and the journals remain extremely healthy.

Impact Factors (2002)

1. Journal of AMS:	2.533
2. Comm. Pure and Appl. Math:	2.022
3. Annals of Mathematics:	1.905
4. Bulletin of the AMS:	1.824
5. Memoirs of the AMS:	1.661
6. Acta Mathematica:	1.621
7. Inventiones:	1.616

(all others are below 1.100)



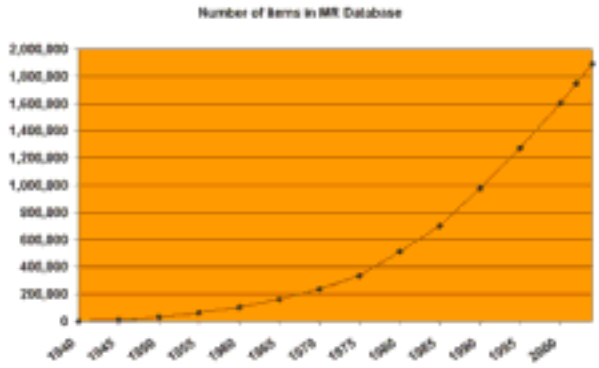
The Society has devoted a great deal of time and energy to its book program over the past 10 years. We now publish approximately 100 new titles each year, and because of our policy to keep *all* monographs in print indefinitely, we list more than 3000 titles in print. We have extended distribution agreements throughout the world and increasingly distribute books for other publishers. We've recently added several benefits for authors of books, including websites for each book (to post corrections and additional material) and author discounts (50% for 5 years on all AMS books). We have evaluated all aspects of the program and we plan to expand our book program further in the future.

Mathematical Reviews

The third part of our publications program is Mathematical Reviews, which plays an increasingly important role both in the mathematics community and in the Society itself. Most mathematicians see only the front face of Math Reviews—either the web version on *MathSciNet* or (less frequently) the large orange volumes. Sitting behind that facade, however, is an enormously complicated set of interlocking components that produce a high-quality product and make it widely available. Mathematical Reviews has become invaluable to mathematicians around the world.

It wasn't always that way. Math Reviews was founded by Otto Neugebauer, who had been the editor for *Zentralblatt für Mathematik und ihre Grenzgebiete (ZBL)*. When *ZBL* began to enforce German racial policies in 1938, Neugebauer resigned his position and immigrated to the United States. American mathematicians discussed how to save *ZBL*, but eventually were led to start a new reviewing journal, which they called *Mathematical Reviews*. Neugebauer and J.D. Tamarkin were its first editors.

In its first year of operation (1940) *Math Reviews* published 2120 reviews in 400 pages.



The staff consisted of 4 people—the two editors, a technical assistant (Willy Feller) and a secretary (Evelyn Spencer). Expenses for the year totaled $14,356.77 and the journal actually showed a small profit.

Over the years, Math Reviews slowly evolved into an ever larger operation, growing from its initial staff of 4 to a staff of more than 70. The operation was originally based in Providence (where Neugebauer and Tamarkin held appointments at Brown), and that was part of the motivation for the Society moving its headquarters to Providence in 1951. For the next 14 years, the Math Reviews staff shared space with the rest of the AMS staff. It was not always an easy sharing, however, because Math Reviews operated as a semi-autonomous unit of the Society, with its Executive Editor reporting directly to the Board. For this reason (and others) Math Reviews moved its offices to Ann Arbor, Michigan, in 1965. That year, it had a staff of 35 and published about 15,000 reviews.

In the intervening years, Math Reviews has had its ups and downs. In the late 1970s, Math Reviews fell behind in reviewing, creating a giant backlog of material, which was subsequently processed in a short period of time in order to catch up. (The number of published reviews rose by over 50% in a single year!) For many years, Math Reviews showed a financial loss for the Society, and there was talk of selling it to commercial publishers. Repeatedly over the years, people discussed merging Math Reviews and ZBL in the hope that this would save costs, both for the Society and for subscribers. Early in the development of the Internet, some predicted the imminent demise of Math Reviews, which would "become useless once all mathematics was available on the Web." Of course, exactly the opposite has happened.

Today, Math Reviews is thriving. Each year it adds more than 75,000 items to the database, which now includes more than 1,900,000 items. Assembling that database requires more effort than most people imagine. The staff chooses from over 100,000 items in about 1,800 journals and many hundreds of books. They deal with nearly 3,000 publishing entities, tracking down material when it is lost and sometimes downloading material from the web. They uniquely identify each of the more than 400,000 authors included in the database, which makes it possible to locate all papers by specific authors (even when names change or are transliterated differently!). They classify, they evaluate, and they annotate articles for further processing. They do all this, day after day and week after week, at the rate of about 350 items per day.

Math Reviews 2003

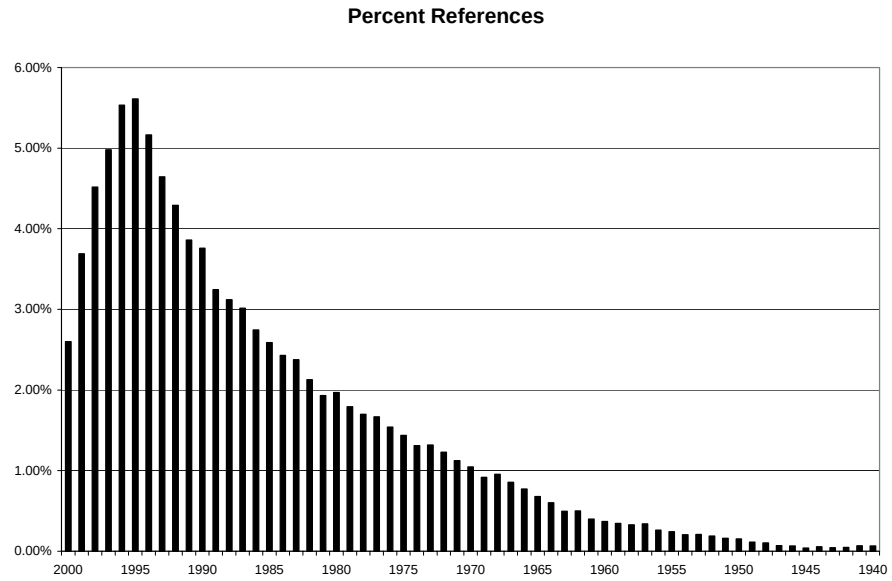
Number of items in the MRDB	1 894 000
Number of reviews in the MRDB	1 661 000
Number of individuals (authors) in the MRDB	400 000
Number of new items added to the MRDB in 2003	77 493
Number of new reviews added to the MRDB in 2003	57 438
Number of new items processed each working day	325
Number of journals currently covered by MR	1 799
Number of classifications in MSC2000	5 529
Number of currently active reviewers	10 843

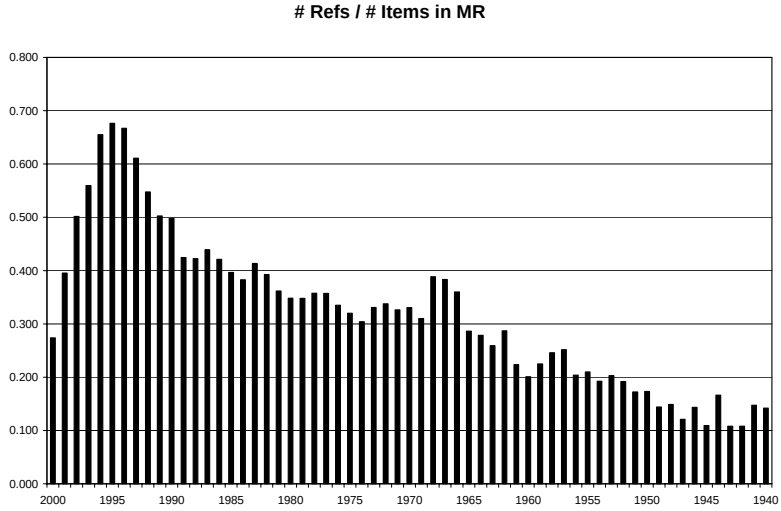
Reviewers are one of the key assets of Math Reviews, of course, and there are more than 10,000 of them today. Editors decide which reviewers should consider which papers, and the staff must track (and gently remind) reviewers to complete their work. Items are lost in transit; reviewers go on leave (sometimes unexpectedly); occasionally items are returned after long periods of time. Mainly, however, reviews arrive and are edited, not just for style and grammar (that's the easy part), but to add detailed references and their corresponding Math Reviews numbers, to make certain that the database is self-consistent and interconnected.

Today, of course, there is even more data to be captured—there are about 120 possible fields underlying each item in the database. The Math Reviews Database now has more than 360,000 links to original articles, allowing users to access the articles under review with the click of a button. The staff adds more links each year and keeps the old ones up

to date. Math Reviews includes a richer and richer collection of internal links that show users which reviews refer to which others, both backwards and forwards. And the most recent additional data is the collection of references for selected journals. It has the potential to add an entirely new way in which to use Math Reviews to understand the mathematical literature.

Beginning two years ago, Math Reviews began capturing reference lists for approximately 100 journals, going backwards to 1997 for most. Using a sophisticated application, we are able to match those references to the corresponding item in the MR database about 80% of the time. (Many items don't correspond to anything in the database, either because they were never published or were never included. The matching rate for items in the database is about 95%.) Like links to original articles, the links from references to the corresponding items in Math Reviews provide a wonderfully efficient way to navigate the literature. The entire collection of data can do much more, however.





With nearly 800,000 references collected so far, we can begin to study and to understand the mathematical literature far better than we ever have before. Mathematicians have always claimed that mathematical literature is valuable for many years after publication (unlike some other areas); we now can make that evident by graphing the year of publication for all references from recent papers. Better yet,

since the number of items in Math Reviews each year measures the approximate *size* of the mathematical literature, we can measure how often the past mathematical literature is still cited. It's a convincing argument that mathematics has a very long life!

For many years, scientists in other fields have used the "impact factor" to measure the quality of journals. The impact factor is measured by Thompson ISI, which compiles citation data for a large collection of journals. For any given journal, the impact factor for a specific year is the number of citations to the previous 2 years of that journal divided by the total number of articles published in the journal in those 2 years. While this provides *some* information, it is clearly flawed for mathematics, mainly because the time frame (2 years) is far too short.

We can use the Math Reviews citation database to gain a much clearer and more sophisticated understanding of this phenomenon. Again, we can use both the citation database and the Math Reviews Database itself to measure the relative frequency of citations. For example, by dividing the number of citations to a particular journal by the total number of articles published in that journal for the past 60 years, we get a much broader understanding of the frequency of citations.

	Journal	**#Items**	**#Refs**	**Ratio**
1	Inst. Hautes Études Sci. Publ. Math.	343	3327	9.70
2	J. Amer. Math. Soc.	486	3333	6.86
3	Invent. Math.	3206	15526	4.84
4	Ann. Sci. École Norm. Sup. (4)	778	3289	4.23
5	J. Differential Geom.	1198	4778	3.99
6	Comm. Pure Appl. Math.	2025	7144	3.53
7	Mem. Amer. Math. Soc.	732	2441	3.33
8	Geom. Funct. Anal.	470	1565	3.33
9	Internat. Math. Res. Notices	553	1757	3.18
10	J. Algebraic Geom.	347	1089	3.14
11	Ann. of Math. (2)	4606	13569	2.95
12	Advances in Math.	379	1030	2.72
13	Ann. Inst. H. Poincare Anal. Non Lin.	537	1356	2.53
14	Math. Res. Lett.	698	1740	2.49
15	Astérisque	954	2348	2.46
16	J. Funct. Anal.	3308	7838	2.37
17	Comm. Math. Phys.	6280	13334	2.12
18	Bull. Amer. Math. Soc. (N.S.)	911	1899	2.08
19	Ergodic Theory Dynam. Systems	1313	2710	2.06
20	*K*-Theory	521	1010	1.94

And of course, we can choose the time period to refine the information.

Of course, citation data can be misused (in some disciplines, self-citations are a major problem) and one should be careful to understand the limitations of citation data (at the moment, the MR data is too limited to be reliable). But over time, as we double the

number of journals and build up a citation database, users of Math Reviews will be able to study the literature in ways they never could have before.

The Mathematical Reviews Database is spectacular, but Math Reviews today is much more than just the database. The Web interface, *MathSciNet*, is what has revolutionized the way in which mathematicians use the database. *MathSciNet* is not a collection of Web pages, however—it is a sophisticated piece of software that undergoes extensive development on an annual cycle. In late winter of each year, staff in the Ann Arbor and Providence offices consider a list of potential improvements and enhancements for the next cycle. They review comments made to the customer support personnel in Providence; they consider suggestions made directly to the Executive Editor in Ann Arbor; and they generate ideas from everyone involved in the publication program.The list is narrowed, modified, and (sometimes) expanded. Development takes place over the next 6 months, and the new version of *MathSciNet* is released to all sites in September. We are currently working on version 10.

Software development produces many of the tools associated to *MathSciNet* as well. One of the most exciting is the recently released MRef tool (www.ams.org/mref), which makes it possible to find an item in *Math Reviews* by entering only portions of the actual reference, even with possible mistakes. (It is this tool that underlies the ability to match the items in reference lists with the corresponding items in Math Reviews.)

To be successful, however, Mathematical Reviews requires even more than a marvelous database and a sophisticated interface. Creating that database and the surrounding software is expensive. Math Reviews is entirely self-sufficient, and in fact, along with other parts of our publications program, Math Reviews makes money for the Society to support our outreach.

Math Reviews has been financially successful because of an effective pricing scheme and hard work. A little more than 10 years ago, the Society changed the way in which Math Reviews was priced. Subscribers were asked to pay a Data Access Fee (the DAF, which this year is $5467 for institutional members) and then to purchase whatever individual

products they chose (in 2004, this is $526 for paper and $1998 for *MathSciNet* or *MathSciDisc*). It was a sensible way to price a database product because it separated the various components—assembling the database and delivering it in various formats. But it also made it possible to create a flexible scheme for pricing Math Reviews for consortia.

Consortia of institutions can now purchase Math Reviews products by joining together. The Data Access Fee for the consortium is the sum of all previous subscribers (no savings there). But adding *new* subscribers does not increase the DAF. Each member of the consortium can then purchase *MathSciNet* at a reduced price of $250 – $1000, depending on "mathematical activity" at the institution. This means that a small college, which never had access to Math Reviews in the past, can join with nearby large universities to access *MathSciNet* for as little as $250 per year. Large *and* small institutions gain by this arrangement, whether or not they previously subscribed. There are now more than 100 consortia around the world involving well more than 1000 institutions.

In addition to the regular consortia, the Society has a National Data Access Fee program that allows certain countries in the developing world to obtain access at greatly reduced prices. Countries currently participating are Algeria, Bosnia, Bulgaria, Costa Rica, Croatia, Estonia, Fiji, Lebanon, Macedonia, Morocco, Romania, Serbia, Vietnam, Yugoslavia, and Zimbabwe.

Keeping track of all the institutions in consortia, as well as the single-institution subscribers is a large job, involving many staff. We have to track subscriptions, send invoices in the right amounts to the right institutions, deal with agents (not always easy), help institutions find a consortium to join, add and subtract Internet addresses for access, etc. This is work is done by our Marketing/Sales and Customer Services departments in the Providence headquarters.

Because of this flexible pricing, the number of institutions with access to the Math Reviews Database has more than doubled during the past 10 years—a remarkable achievement at a time when journal subscriptions are under enormous pressure.

By almost every measure, Mathematical Reviews is healthier now than at any time in the past 64 years. It is used by mathematicians everywhere; it's widely admired; and it's financially secure. We have reached this state through the efforts of people over many years (including the present Executive Editor, Jane Kister, who will retire in July of this year).

Twenty-five years ago, when Math Reviews was struggling, *some* people had the foresight to make certain that the underlying database was computerized — long before they were certain about its usefulness. *MathSciNet* was developed initially at considerable expense, largely because people had the belief that putting a database online was the right thing to do. When the Society decided to add the old reviews from prior years, it invested nearly

$1,000,000 keyboarding those reviews. It was an investment that paid off. We need to continue to invest in Math Reviews in similar ways in the future so that it remains a vital part of the Society's publication program—in many ways, the most important part. And we will.

John Ewing
Executive Director