The Mathematicians at the Heart of MathSciNet®

Associate editors at *Mathematical Reviews* share how their work makes possible an invaluable research tool

Scott Hershberger

In the historic Old West Side of Ann Arbor, Michigan, sits a four-story brick building with unusually sloped hallways and a labyrinthine arrangement of staircases. These peculiarities convey memories of the edifice's past as a brewery—but fermentation vats and bottling lines gave way decades ago to bookshelves and offices. Since 1984, the site has brewed and distributed mathematical knowledge as the home of the AMS's *Mathematical Reviews* (MR).

Figure 1. The home of *Mathematical Reviews* is a former brewery in Ann Arbor, Michigan.

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Founded in 1940 by Otto Neugebauer, MR began as a monthly publication reviewing the latest mathematics papers. In 1996, the AMS launched MathSciNet,[1] the online version of MR, which has ballooned into a "ginormous database that indexes literally millions of mathematical items," said Heather Jordon, an associate editor at MR. In a typical year, 24,000 mathematicians from around the world review a total of 42,000 mathematics publications to help fellow researchers stay abreast of new developments—and every single review is solicited and edited by associate editors like Jordon.

Figure 2. Heather Jordon.

A combinatorist, Jordon initially followed a traditional academic career path in mathematics. She joined the faculty of Illinois State University in 2002 and became a full professor in 2010. But soon she found herself ready for a major career shift. Jordon took a position at MR to provide a different service to the discipline.

And what a vital service it is: With MathSciNet, mathematicians can quickly determine what's been done already on the problems they're pondering, evaluate the relevance of a multitude of papers, and follow threads of inquiry

[1] https://mathscinet.ams.org/

through the literature. All of this is made possible by a dedicated team of mathematicians, copy editors, cataloguers, programmers, and others working diligently behind the scenes. While serving as an associate editor is a possibility that mathematicians do not often consider, Jordon and her colleagues find it a fulfilling role.

From Published Paper to Review in MathSciNet

Throughout its more than 80-year history, MR has evolved along with technology. The last print issue of *Mathematical Reviews* arrived in libraries and mailboxes in 2012; since then, MathSciNet has continued expanding in content and features. Meanwhile, intimidating piles of print journals, once omnipresent in the MR office, are now almost entirely supplanted by online versions. Nevertheless, the process by which a new review appears still follows the same core steps as it did decades ago.

The 16 associate editors—all PhD mathematicians—each oversee a set of Mathematics Subject Classifications (MSCs) as well as a related set of journals. As an editor combs through journals in the "prescanning" phase (with the help of specialized software), they determine which papers to include in MathSciNet under which MSCs. At the same time, "for each of the papers, you decide [whether] this is a paper that we're just going to index, or we're going to assign to it the author summary, or we're going to send [it] out for an external review," explained associate editor Andrés Eduardo Caicedo. Meanwhile, cataloguers make sure that the paper's authors are matched to the correct profiles in MathSciNet.

Figure 3. Andrés Caicedo.

Caicedo, who has worked at MR since 2015, first encountered the "big orange volumes" of *Mathematical Reviews* as an undergraduate at the University of the Andes in Colombia. At MR, he handles mainly mathematical logic and foundations (MSC 03) and computer science (68), plus two smaller areas: general algebraic systems (08) and order, lattices, and ordered algebraic structures (06). Matching a paper to a reviewer is "a bit of an art," Caicedo said. "We have a big database, but in the end it's a bit subjective." MR editors try to find a reviewer who isn't a close colleague of the authors, yet whose expertise relates to the topic of the paper.

When the draft of a review comes in, the staff of Reviewer Data Services checks the TeX, and a copy editor cleans up the language and citations. Then, the assigning editor uncaps their (now metaphorical) green pen to closely examine the review's content. "I'm reading it for grammar, style, making sure the math is correct, making sure that the way that things are phrased is going to be understandable to another mathematician," said Jordon, who manages combinatorics (MSC 05) and information and communication theory (94).

As users of MathSciNet know, reviews range widely in length. Michael Atiyah, for example, had a knack for writing crystal-clear single-paragraph reviews. Other reviews dive into more detail and thus are much more time-consuming to edit.

"In logic, for instance, a lot of the reviews tend to be a bit long," Caicedo said. "So even if at the end, there aren't that many reviews, [one review] might require that you go and consult references, and it might take an hour or more to go through."

When the first editor is satisfied, the review passes to the desk of a second editor (who first-edits different MSCs). From there a copy editor does a final check before the review is posted to MathSciNet, thus completing the journey. All in all, at least five people, two of them mathematicians, have pored over the review to ensure that it meets MR's high standards for accuracy and clarity and appropriately links to other items within the database.

## The People Behind the Machine

Day-to-day mathematics research is like peering through a microscope at a tiny subdomain of knowledge, according to MR associate editor Amanda Francis. She came to Ann Arbor in 2018, drawn by the prospect of seeing her work in the context of a bigger picture.

Francis's research background is in algebra and algebraic geometry. By overseeing associative rings and algebras (MSC 16), group theory and generalizations (20), and general topology (54) at MathSciNet, she engages with broader trends beyond her subfields. She also manages general and overarching topics (00), a catchall for publications that do not fit into the other MSCs, including popularization and philosophy of mathematics.

While MR editors are free from the pressure to constantly publish, most continue some research. They have access to the University of Michigan's library system and receive funds for conference travel. Caicedo recently completed a semester-long "study leave," MR's version of a sabbatical, during which he worked on a book about the partition calculus of countable ordinals.

In one of her current projects, Francis is using the idea of electrical resistance as a way to measure distance in social and biological networks. "I am able to contribute to my research projects in a different way now than I used to," she said. "I know a lot more about what's getting published and where, and that has given me a lot of insight."

Though she enjoys each facet of her work as an associate editor, Francis described the step of assigning publications
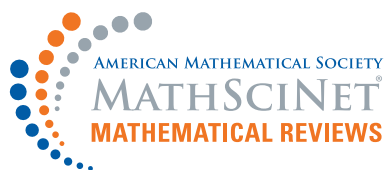
AMERICAN MATHEMATICAL SOCIETY
MathSciNet®
MATHEMATICAL REVIEWS
by the numbers

ITEMS INDEXED:
4.04 million TOTAL 130,000 ADDED EACH YEAR

1,650
CURRENT
JOURNALS INDEXED

24,000
ACTIVE REVIEWERS

42,000
NEW REVIEWS
EACH YEAR

STAFF:

17 Copy Editors	10 Acquisitions	1 Director of Operations
16 Associate Editors	8 Reviewer Data Services	1 Executive Editor
12 Cataloguers	7 IT Department	

to reviewers as her favorite. "It's sort of like a matching game, […] but it's more fun […] because it works better if you learn a little bit about the cards you're holding." Caicedo, by contrast, most enjoys the editing itself. He sets aside two days per week to focus primarily on editing, though the other steps in the process do require some daily attention.

The number of journals and pace of reviews crossing an associate editor's desk both vary widely depending on MSCs. Jordon was responsible for 88 journals in recent months, while Francis juggled around 100. Each week,

Francis first- or second-edits upward of 100 reviews. Sometimes that number rises as high as 200—during those busier times, her journal load is lowered to compensate.

"It's nice when people realize that there are actually people behind this machine [MathSciNet]," Caicedo said. "There are other mathematicians checking the quality of what is going on. I think it humanizes the process a lot."

Francis said that working at MR presents an "unmatched ability to be engaged with worldwide mathematical research in an interesting way." She encouraged any curious readers to apply to join her as an associate editor. At the same time, she emphasized that the power of MathSciNet stems from not just the staff, but also the global community of mathematicians who write reviews for the database.

"If you're at the stage in your career where you have time to do that, we need you," Francis said. "We can't work without all the mathematicians in the world helping us out."

Figure 4. Amanda Francis assigns MSCs to a hard copy of a collection of articles in 2019. Spurred by the pandemic, this process is now done entirely digitally.

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