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MSRI Addresses the Challenge

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The Mathematical Sciences Research Institute: purpose and goals

Founded in 1981, the Mathematical Sciences Research Institute (MSRI) aims to further mathematical research through broadly-based programs in the mathematical sciences and closely related activities. MSRI realizes this goal by hosting researchers in semester- and year-long programs in key and timely areas of research in the mathematical sciences, training the next generation of researchers, reaching out to ensure equitable representation of historically underrepresented populations in its mathematical activities, and communicating the power and beauty of mathematics within the profession and to the general public.

MSRI typically hosts two major programs at a time, each lasting a semester or a year. Those programs, designed to support and enhance communities of researchers and catalyze their collaborations, represent the core of our mission. Long-term visitors come for periods ranging from one month to ten months. During a semester-long program, MSRI becomes a world center of activity in the field of the program, with visits from top experts as well as from those who will become the next leaders. Welcoming about 1700 visitors a year, MSRI also sponsors or hosts workshops on diverse mathematical and educational issues; summer programs for undergraduate students, graduate students, and faculty; and diverse public events both at MSRI and elsewhere in the world.

An awakening

In the mid 1990s, Bill Thurston and Lenore Blum, then Director and Deputy Director of MSRI, were concerned about the lack of diversity in the Institute's programs. They created the Human Resource Advisory Committee (HRAC) in response. The HRAC was mandated to advise MSRI on how to be inclusive, diverse, and equitable. Over the years the committee proposed several new activities meant to encourage researchers from a variety of backgrounds to learn about a new field as well as to provide ample opportunities for people to network and form lasting collaborations.

When the first author of this chapter came to MSRI in 2008, she was certainly aware of inequities, implicit and explicit bias, and even outright discrimination in academia and in mathematics. She worked to ensure that MSRI would be diverse and inclusive and that MSRI would provide a collegial environment to all. In the words of Silvia Bozeman (former HRAC member and later co-chair), MSRI would be “a home away from home.” With increased efforts to reach out to members of groups underrepresented in mathematics, H el ene felt that MSRI was doing as well as it possibly could. There was a pipeline problem and that was certainly not for MSRI to solve, she thought. After all we were “simply” a research institute with goals to promote research. The pipeline issue was the domain of the universities. Then it dawned on us that graduate chairs of math departments had a similar way of thinking: *Despite our best efforts at reaching out to underrepresented groups, we cannot improve their representation in our departments. We have done everything we can. It is a problem for the undergraduate chairs.* This process continues from one level to the next and soon we realize that it is a problem of society—certainly we cannot be expected to solve it. This line of thinking may be rational, but it leaves the problem unsolved.

Realizing that it was—and is—MSRI’s problem was an important step in our approach to improving the representation of women and minority groups. Facilitating development, cooperation, progress, and inclusiveness for those with different backgrounds, at different stages of their careers, and from many different institutions requires multifaceted efforts. In addition, it is important to recognize that for some populations inequities exist and need to be redressed. For some a remedy is to increase the visibility and impact of their research, for others it is to increase their productivity by catalyzing collaborations. At MSRI everyone from the building manager to the trustees has become invested in making a difference. Governing committees are dedicated to ensuring that diversity, inclusivity, and equity are an integral part of *all* activities. Special programs have been established to bring to the institute people who have been historically underrepresented or marginalized. Targeted networking workshops were created to provide a sense of community. Carefully designed outreach programs were established to welcome everyone into our mathematical community.

By approaching the problem from as many angles as possible, MSRI has significantly increased the participation of historically underrepresented groups in its activities. This chapter focuses on some of the measures MSRI has taken to make inclusivity, diversity, and equity an integral part of the institution. In turn, these initiatives support and enhance communities of researchers at MSRI.

MSRI’s semester programs and workshops

To meet our goals in the semester programs and workshops, MSRI implements various activities from the planning stage through the exit surveys.

At the planning stage

Planning for a program begins at least two years in advance and proposals (both solicited and unsolicited) are reviewed by MSRI’s Scientific Advisory Committee (SAC), and its Human Resources Advisory Committee. The SAC is a rotating committee that selects and plans the Institute’s programs and works with the organizers of these programs on selec-

tion of key participants. The HRAC augments the SAC's care for human resource issues. HRAC's ten members help recruit participants from underrepresented groups and develop new MSRI activities to promote the involvement of these groups in the mathematical sciences. For example, at the very beginning of the process, proposal teams must designate an Organizing Committee which is representative of the mathematical community, including at least two women. In our experience, when female mathematicians serve on an Organizing Committee, it generates a more diverse list of applicants and participants. This outcome is consistent with yearly statistics compiled by the AMS which found a strong correlation between having women organizers and the number of women speakers in AMS special sessions (see, e.g., "Statistics on Women Mathematicians," Notices of the AMS, October 2018, 2019, and 2020). In addition, MSRI's Human Resources Advisory Committee is involved in all the activities of MSRI and guidelines require that organizers of activities must respond seriously to its recommendations. HRAC also advises on the selection of special programs aimed at underrepresented groups and aids MSRI in the evaluation of its programs and diversity efforts.

During the program

When researchers are invited to MSRI, they are given information concerning visitors and family services. MSRI's Family Services Consultant assists mathematicians in finding schools and childcare in Berkeley. Between Fall 2014 and Spring 2020, this consultant assisted 192 members with securing childcare services and school enrollment for over 240 children. The generous support of private funders allows the Institute to offer family support to women participants in our programs and workshops who have children ages 14 and under. The funds are intended to offset the cost of childcare to enable mothers to focus more easily on research during their stay at MSRI. Recipients may use these grants for childcare expenses from local resources in Berkeley, or for any other form of childcare (such as hiring a nanny at home, bringing a caregiver with them to Berkeley, etc.) in order to give recipients the freedom to use these funds in a way that is most useful to their family. Both of these programs are particularly helpful to women hoping to participate in the Program, since the burden of caring for young families still falls disproportionately on women.

I am incredibly grateful for the financial family support I have received during my stay at MSRI. It allowed my family to acquire the after-school care we needed, allowing my husband and myself to work knowing our daughters were well cared for. Additionally, without the worry of the added financial burden of childcare, I found it easier to focus on my work, attend workshops and talks, and participate more fully during the GTC program. The family support offered by MSRI made my stay here that much more enjoyable and productive. Thank you!

—2017 participant, Geometric and Topological Combinatorics

Childcare support is important not only for the parent, but also to all participants of the program as well, as this comment from a male postdoc about his mentor suggests:

At the Fall 2018 MSRI program on Hamiltonian Systems I was introduced to [...]. While I was familiar with her work, I had not yet met her at any recent conferences.

We started collaborating on an exciting new project early in the semester and she served as an unofficial postdoctoral mentor for me, offering feedback on my talks and other career advice. After the MSRI program I started a new postdoc, close to [...]’s home institution. In addition to our continuing collaboration, she has helped introduce me to mathematicians in this area. Caring for a young child limits one’s ability to travel, and had [...] not been able to attend the MSRI program, my experience in Berkeley would have been greatly diminished. —2018 male participant, Hamiltonian Systems

Once a program begins, MSRI becomes a hub of mathematical activities. Among the special features of the programs are the Connections and Introductory Workshops and the Postdoc Program.

Connections Workshop and Introductory Workshop A program begins with a Connections Workshop (CW, formerly Connections for Women) and an Introductory Workshop (IW). The CW facilitates social networking in a mathematical context where mathematicians who identify as women are a majority and includes both a discussion session on career development and a dinner for the participants. As is the case for all MSRI workshops, registration to attend Connections Workshop lectures is open to all interested researchers regardless of gender. What makes this workshop stand out from others is that the speakers are mainly women. Some participant comments attest to its impact:

I appreciated the diversity of the group of participants: mostly female and from many different backgrounds. Scheduling the Connections for Women workshop right before the Introductory Workshop is very effective, since then during the Introductory Workshop women have already formed some connections with other participants, and are already familiar with the Institute. Personally, the Connections for Women workshop has led to a potential new collaboration for me with one of the speakers.

—2017 Participant, Harmonic Analysis

This is my first workshop that has a gender perspective to it, and I loved it. Not only was it great not being the only woman in the room, but also the panel discussion motivated some great discussions and gave some really good points.

—2019 Participant, Derived Algebraic Geometry, Birational Geometry and Moduli Spaces

The panel session was really stimulating (to me as a “senior” male who has done lots of training in unconscious bias etc but who still learned a lot ...).

—2017 Participant, Harmonic Analysis

The IW immediately follows the CW and is meant to set the stage and provide the context for the program. The intended audience includes members in the other programs, members of the local mathematical community, and participants from outside the area selected especially for the workshop, particularly women, minorities, mathematicians not located at research centers, and graduate students. In selecting participants, priority is given to these latter groups. One of the objectives is to help mathematicians break into a new area of research. These introductory workshops have been effective in broadcasting the goals, ideas, and techniques of a particular field to the mathematical public at large, as well as in bringing the MSRI community together as a whole.



Introductory Workshop of the Microlocal Analysis Program, Fall 2019.

Postdocs A program typically includes postdocs. MSRI strongly believes that both formal and informal mentoring are important roles for established members of the program. Thus MSRI emphasizes this responsibility throughout the preparation and implementation of the program. The mentor and the postdoc are expected to designate a weekly meeting, including a discussion at the beginning of the semester about the project(s) the postdoc will pursue. The mentor is expected to introduce the mentee to senior members in the postdoc's area, give advice and feedback concerning the writing of papers and grant proposals, presenting talks, the ins and outs of publishing, and various other professional issues that arise in the course of their career. Early in the semester, the Directorate has several lunches with small groups of Postdocs to learn about each of them and make sure that the mentoring and involvement in the program are going smoothly. This one-on-one mentoring is meant to provide a safe and stimulating environment for all postdocs.

After the program

Before leaving MSRI, all members complete an exit survey that provides feedback on their experience. MSRI also writes to a selection of members who have attended programs two, four, and six years earlier. The following comments capture some of the long-term impacts:

Another long-term impact is the collaboration between researchers in commutative algebra and in cluster algebra, which was the topic of the sister-program that Fall... The human resource story is also impressive. Our post-docs were quite diverse and began many successful collaborations and made contacts that eventually led to strong careers. All but one of them is now in a long-term position at a university!

—Organizers, 2012–13 Commutative Algebra Program

I participated while being a postdoc in Germany and was able to make several lasting connections during the stay at MSRI, some of which are leading/have led to very fruitful collaborations. Also, I made lasting contact with several leading figures in the field whom I now feel more inclined to ask research and career help questions.... The younger generation of our community/field is well-networked due to the program and this led to many collaborations and also contacts, where we ask each other questions slightly out of our own respective area.

—Research Member, 2013–14 Mathematical General Relativity Program

Reaching out and bringing in: other activities to broaden participation

Other activities to redress inequities and promote inclusivity reach beyond our programs. These include the following:

Summer Research in Mathematics (SRIM) Existing women's mathematics conferences are valuable collaborative opportunities, but they are also very short in duration, typically lasting only a week, meaning projects remain unfinished once the participants return to their usual professional and personal responsibilities. MSRI's Summer Research in Mathematics program provides space, funding, and the opportunity for in-person collaboration to small groups of mathematicians, especially women and gender-expansive individuals whose ongoing research may have been disproportionately affected by various obstacles including family obligations, professional isolation, or access to funding. Researchers work on a project for two-to-three weeks at MSRI during the summer. Through this effort, MSRI aims to mitigate the obstacles faced by these groups, improve the odds of research project completion, and deepen their research experience. Private sources of funding for family support make it possible for women with children to fully participate in its scientific activities. Thanks to grants from the National Security Agency, the Lyda Hill and the McGovern Foundations and Microsoft Research, full support is provided including lodging, food, and travel. Beginning in 2017 with four groups for a total of sixteen women, this program increased to six groups totaling twenty women in 2018, to thirteen groups totaling forty-six women in 2019, and to eighteen groups totaling 81 women and one man in 2020. A total of 29 papers have been published, accepted, or submitted from these four summers. The Summer Research in Mathematics program is extremely popular and has a very competitive application process (in 2019 there were 153 applicants, and in 2020 there were 294).

We also visited quite a bit with others at MSRI. In particular, some of these lunch/tea time chats resulted in invitations to speak at another participant's home university. This also led to a lot of discussions about what we can do to promote both our own careers and those of women in mathematics in general. Bringing collaborators together is so important. There is so much more progress we can make on our joint projects when we can work through ideas in person. Further, it is likely that neither of us could have arranged such a meeting if this program didn't also cover travel and other arrangements for our children. In a female-only collaboration I think we both stop censoring ourselves so much. We throw out crazy, naive ideas that turn out to work, or to lead us to something else interesting, or to just fall flat. In any case, we ask and answer the

“dumb” questions, instead of assuming that the answers are obvious to everyone else. Often, they’re not obvious, and lead to really nice results. —2019 participant

Our week at MSRI enabled us to develop a small project into something substantial. We are working slowly for exactly the same reasons that [the time at MSRI] helped us: we are overflowing with commitments at home (eight children across three authors!), and the isolation permitted the focus needed to advance. —2017 participant

The African Diaspora Joint Mathematics Workshop (ADJOINT) ADJOINT is designed for US researchers with PhDs in the mathematical and statistical sciences, especially those from the African-American mathematical community, who are interested in conducting research in a collegial environment. Beginning with a two-week summer workshop at MSRI, small groups of mathematicians work with research leaders on various research projects. The ADJOINT program continues throughout the year by providing support for periodic virtual meetings as well as travel funds to enable visits among collaborators. MSRI also provides additional support for participants to present results at national and international conferences and publish in peer-reviewed journals. The 2019 ADJOINT pilot workshop consisted of twelve mathematicians who participated in one of three research groups. A respected African American mathematician with a well-established research program led each group. S. J. Gates led a group of three mathematicians on “The Study of Mathematical Adrinka Symbols: From Physics to Mathematics Investigations Across Algebraic Topology and Graph Theory.” Group member Kevin Iga of Pepperdine plans to publish a book to make the development of this young topic accessible to the mathematical community. Michael Young worked with a group of four researchers on tournament problems and Edray Goins, together with five other mathematicians, studied compositions of Belyi maps and their monodromy groups. Both of the latter groups are working on publications. All teams were predominantly comprised of African-American mathematicians at various stages in their careers.

It was great working with other African Americans. However, for me the best part about the program is that more African Americans will be writing papers together and presenting to the math community. [ADJOINT] can make a direct impact on the number of research papers authored and conference presentations given by African Americans. That is a huge positive.

... I think this program is an absolute triumph in and of itself. The real work might be in determining, via longevity of the program, sufficient tweaks in order to foster enough interaction with groups who participate, and early career African-American mathematicians so as to create space and a bit of momentum for bona fide mathematical collaboration to develop.

Summer Graduate Schools Each summer, MSRI organizes and runs several Summer Graduate Schools on topics of exciting current research. In recent years MSRI organized between ten and twelve schools each summer. At these two-week events, forty to sixty students meet with their peers and future colleagues from all over the world, in an environment of intense collaborative work. MSRI widens the pipeline of talented mathematicians by actively encouraging summer school applications from members of groups

currently underrepresented in mathematics. Recently, 85% of the participating students are US-based and from all regions in the country. Graduate students can be nominated from all institutions, but each of MSRI's 110 Academic Sponsor institutions are allowed to send two students to MSRI's Summer Graduate Schools; or three students if at least one is a woman or minority; or four if the group includes both a woman and a minority. This last option went into effect in 2016 and has resulted in a substantial increase in the number of women and minorities sent by sponsors. In 2015 there were 28% women and 11% from other underrepresented groups while in 2018 the percentages were 30% and 19%. These comments from three attendees at the 2018 ∂ -Problem in the Twenty-First Century Graduate Summer School highlight the success of the program:

The material was really great, but perhaps even better was the chance to meet and work with others in my field. Though I am surrounded by other grad students in Math or even Analysis in my department, it's much harder to find colleagues in my field. Working with others who have similar backgrounds to my own and are interested in similar questions was an amazing experience. I learned more in the two weeks of working with these new friends and colleagues than I had learned in months of working on my own.

The best part about the summer school was interacting with the other people at MSRI outside of the lecture hall. In fact, I am now collaborating with another student on an idea we had one afternoon while chatting in the common area and there may very well be a paper in the works.

I think no word can be used to express the joy, the surprise, and satisfaction I have revived here. It is something that not only encourages me very much, but also makes me appreciate what math really is. The subject might be seen as difficult, but the fun is uncountably infinite!

MSRI's Undergraduate Program (MSRI-UP) MSRI-UP aims to increase the number of graduate degrees in the mathematical sciences, especially doctorates, earned by US citizens and permanent residents, by cultivating previously untapped mathematical talent within the US Black, Hispanic/Latinx, and Native American communities. Each summer eighteen college students participate in a mathematics research program under the direction of faculty and graduate student mentors. They complete a research project in collaboration with other MSRI-UP students. They also attend workshops aimed at developing skills and techniques needed for research careers in the mathematical sciences. They learn techniques that will maximize a student's likelihood of admission to a graduate program as well as the likelihood of being awarded a fellowship. After a rigorous summer research experience, MSRI-UP participants encounter a long-term support structure that offers mentorship for the rest of their careers. The program's effectiveness is demonstrated by the fact that since its inception thirteen years ago, 223 students have participated in MSRI-UP. Of these, 164 went to graduate school and, so far, 70 have received master's degrees and 37 have received PhDs in the mathematical sciences. A further strength of the program is its successful focus on cultivating the underutilized mathematical talent within the Black, Hispanic/Latinx, Native American, and Pacific Islander populations, which constitute 89% of MSRI-UP alumni.

This has been, by far, the best research experience I have ever had. I have been involved in four different research projects and only now I feel like I know what mathematical research is all about. —2014 participant

The most memorable experiences were working with other black math students. It is an impossibly rare luxury for me to be able to work with black math students or even better, talented black math students. —2015 participant

Before this program, I was thinking about enrolling in a master's program. Now I am absolutely sure that I will be applying to PhD programs. —2016 participant

When we were able to define the group action on the induced Sperner's labeling, I was so happy that I could not stop smiling. It just reminded me how beautiful knowledge is, and how much I enjoy doing mathematics. —2015 participant

By making mathematics accessible and fun to all, we believe that more young people will be interested in it and will later consider mathematics as a possible discipline to study.

How successful are we? Measuring outcomes

MSRI measures success using qualitative and quantitative metrics. We collect demographic data on our program members and participants and have a dedicated staff person to analyze this data. For example, in the nine-year window from 2009–10 to 2017–18 (the most recent year with published data from the AMS): MSRI averaged 23% women among US-based research members (those in residence at MSRI for at least one month) while the AMS data reports 19% women among full-time doctoral faculty in all US math departments and 16% women among full-time doctoral faculty in only large public and private US math departments. For the same time period, MSRI had 28% of its US-based postdoctoral population identifying as women while the AMS reports 21% of non-tenured mathematicians at PhD-granting US institutions (and 20% at public and private large institutions). Of the US citizen and permanent resident postdocs, 16% have identified as members of underrepresented groups with 8% Hispanic and 7% Black, compared to 3% Hispanic and 3% Black among all US and permanent resident recipients of a PhD in mathematics.

Exit surveys indicate that the level of satisfaction for a participant in a long-term program at MSRI is extremely high. On a scale of 1 to 5, with five representing the highest score, satisfaction on average to the question, “Professionally my overall satisfaction with MSRI” is 4.75. These scores are the same whether the members are from underrepresented groups or not. A year-and-a-half ago we also added the following question to our survey: “MSRI aims to provide a supportive environment for all program participants, how satisfied were you with this aspect of your experience.” The average score was 4.6 for women and members of other underrepresented groups, while it was 4.81 for men. Lastly, personal comments are very important to MSRI, and mathematicians are generally candid in their answers. They do point out areas where we can improve, and we take their comments to heart and make appropriate changes. For example, the Connections for Women has evolved considerably since its inception. It is now open to all and each program decides on its format. The program has even changed names while the purpose has

remained the same. Participants in MSRI's programs also share their enthusiasm with the activities described in this chapter, and overall they have strongly encouraged us to pursue the activities such as SRIM, ADJOINT, MSRI-UP and the Connections Workshops.

The continuing challenge

Building and maintaining an inclusive community is an ongoing challenge. It requires us not only to implement activities that support this goal but also work to mitigate the effects of long standing inequities. Acknowledging and responding to the forces that have blocked these goals is our responsibility. Our efforts must be broad and intentional in all our activities. Experience shows that without continued vigilance and efforts, the system reverts to old patterns. Pursuing, refining, and improving our activities, looking for new ways to move forward, sharing our experiences, and supporting each other leaves us hopeful that MSRI will help the broader mathematical community meet the challenge of creating and sustaining inclusive communities.



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